ANNALS

OF

The Entomological Society of America

Volume XLI DECEMBER, 1948 No. 4

THE HOVERING AND MATING OF TABANIDAE: A REVIEW OF THE LITERATURE WITH SOME ORIGINAL OBSERVATIONS

NORMAN S. BAILEY

Department of Biology, Boston University, Boston, Massachusetts

When the observed mating of *Tabanus nigrovittatus* Macquart was described to Dr. Joseph C. Bequaert, he commented on the scarcity of such reports. This encouraged me to watch particularly for such activity on the saltmarshes of Essex County, Massachusetts, during the summer of 1947. Before reporting my observations, however, it seems desirable to review the known literature on this topic. The records are widely scattered and usually consist of fragmentary notes without any clear index references.[1] Consequently, students of the Tabanidae will doubtless find some omissions. The writer will be most grateful to the reader who calls such items to his attention.

REVIEW OF THE LITERATURE

The statement with which Surcouf (1921a) prefaces his remarks on this subject, "Les Taons s'accouplent dans des conditions généralement inconnues", is still valid. Our present knowledge remains meagre. This summary of reported observations will emphasize how few facts we now possess. These facts, contributed by about a score of workers, furnish a good basis for further investigations. It is hoped that this compilation of data will focus the attention of others on the hovering and mating habits of the Tabanidae.

Europe.—Brauer (1880) was apparently the first to remark on the habits of male Tabanidae. Surcouf (1921a,b) and Bouvier (1945) state that Brauer noted swarms of *Tabanus sudeticus* Zeller mating on the wing in the Tyrolian Alps. On seeking out the exact words of Brauer, we find the following note under this species on the page to which Surcouf alone refers directly (Brauer, 1880, p. 185): "Die Männchen rutteln und schwärmen über den höchsten Bergspitzen vor Sonnenaufgang, z. B. am Dobratsch (Buchmüller) und Hohen Zinken (Frauenfeld) und sitzen an sonnigen Planken des Morgens nach dem Auskriechen; die Weibchen auf Blättern von Gestrauchen und auf Vieh". Here I find

[1] I wish to express my sincere thanks to Dr. Joseph C. Bequaert for his willing, energetic assistance in locating several of the articles herein reviewed.

no mention of mating. Again Surcouf (1921a,b) and Bouvier (1945) report, without reference to any published account, that Régimbart and Moisson saw many matings of an unidentified horsefly take place in air before sunrise on the Esel at an altitude of 2,000 meters in late July, 1905 with the temperature between 5° and 6° C.

Although Verrall (1909) gives no original observations, he says that "Colonel Yerbury informed me that he has seen males of *Haematopota*[2] dancing in small groups in hot sunshine, and he also observed the male of *Therioplectes distinguendus* hovering". In addition, he states (without clear reference) that both Osten Sacken and Schiner mention the hovering of males, a habit which subsequent records confirm and strongly indicate is associated with mating.

The next European to note male activity seems to have been Kirkpatrick (1918), who saw males of *Therioplectes distinguendus* Verrall hovering in large numbers in sunlight over a road from 6:30 to 10:00 a. m. (Greenwich time). Males of *Tabanus bromius* L. were common in the same vicinity but were resting on palings.

Jones (1922), also in England, was chiefly concerned with the "drinking" habits of the males, but it is at least possible that careful observation in such habitats as he describes might lead to the discovery of the mating activities of the nine species reported. These were of four genera, as follows: *Chrysozona*, one species; *Therioplectes*, two; *Tabanus*, three; and *Chrysops*, three.

Just before sunrise on a July morning Surcouf (1921a) observed the mating of *Chrysops caecutiens* L. on the blades of reeds over water. The mating of *C. quadratus* Meigen was later noted under similar conditions (Surcouf, 1921b).

Males of *Chrysozona pluvialis* L. were seen by Goffe (1931) hovering over *Spiraea ulmaria* in the mid-morning sunshine of his British garden. His later article (1935) adds to our knowledge concerning the "drinking" habits of the males of several other species in addition to those mentioned by Jones. Both papers include some information about the food habits of adult males. This is another topic that deserves to be reviewed and to which several of the other papers cited give isolated references.

Cameron (1934) saw a swarm of clegs in full sunlight above a reservoir in Scotland at 11:00 a.m. on a July 19th. He noted that they were exceedingly active and saw pairs meet momentarily and quickly separate. An occasional individual, or perhaps a pair, was seen to leave the swarm and was soon lost to view. This flight lasted for only five minutes, for the flies dispersed when a passing cloud briefly obscured the sun, and they failed to reassemble. Three males were captured from the swarm. At 10:30 a.m. on a July 5th another swarm of *Chrysozona pluvialis* (L.) was seen near enough to the shore of Loch Garten to observe mating on the wing. Specimens of both sexes were taken from this flight.

Bouvier (1945) reported additional observations on European species in Switzerland. He tells of taking many males of *Tabanus sudeticus* Zeller, *T. apricus* Meigen, *T. maculicornis* Zetterstedt and *T. bromius* L. on a warm day between 8:30 and 9:00 a.m. near the source of a stream. They were flying 60 cm. to a meter above the

---

[2] *Haematopota* = *Chrysozona* (see Goffe, 1931).

ground and were easily netted. None were seen after 10:30 nor on following days. He believes that the males die soon after mating and that mating occurs just after emergence.

The same author once saw several males of *Therioplectes fulvicornis* Meigen hovering like syrphids about 30 cm. from the sod over a damp, sunny Swiss meadow at 11:00 a.m. His descriptive language well expresses their mode of flight and applies as well to the hovering of other species of Tabanidae: "Brusques et rapides crochets, puis l'insecte reprend son vol sur place". He states that the male darts after the female and that mating takes place on the wing. His assertion that the two insects swiftly disappear and rise almost vertically to a great height demands confirmation, however. It is more probable that, as in the instance clearly reported by Philip (1942) and as suggested by the observations of Webb and Wells (1924), Cameron (1934) and others, the pair passes quickly out of sight and shortly after the observer loses track of them they come to rest in nearby vegetation where copulation is consummated.

Africa.—There are a few references to the habits of species from different parts of this continent. Neave (1915) simply notes that both sexes of *Silvius monticola* Neave were abundant in the short grass on the more open parts of the Mlange Plateau of southern Nyasaland. He found them emerging at the time of his visit and many were captured while they were copulating.

Surcouf (1921b) notes that he once saw about 50 males of *Tabanus auropunctatus* Macquart resting on a small stone bridge over a wadi near Rouïba while the females harassed a herd of cattle several hundred meters away. When the herd came to water about 3:00 p.m., nearly all of the males flew towards the females and matings at once took place in air. Three copulating pairs were collected on herbaceous plants at the water's edge.

Surcouf several times saw males of *Tabanus algirus* Macquart flying in different Algerian localities (Rouïba, Fondouck, Belle Fontaine) where the females were emerging. Such males hovered, like *Eristalis* or *Bombylius*, less than a meter above the ground, sometimes only a few centimeters above the cool herbs. At times two or three males hovered over the same spot and, if disturbed, they would make a short, swift turn and come back to the same place to hover against the wind. He watched the emergence of a female. She disengaged herself from the soil and crawled up on a tuft of *Cynodon dactylon* L. where a male seized her. The pair was captured as mating was initiated. In the vineyards of Fondouck, Surcouf also saw males of *Pangonia maculata* Fabricius hovering in uncultivated sections as if awaiting the appearance of females.

Bouvier (1945) noted a large number of *Chrysozona denshami* (Austen) mating on grasses at nightfall in January in the Belgian Congo. Males and females appeared to be in about equal numbers.

Palestine.—Buxton (1924) noted that males of *Chrysozona sewelli* (Austen) hover around the heads of mounted men and their horses while the females are feeding.

North America.—Since the source material is more familiar, this part of the study is, perhaps, more nearly exhaustive. Nevertheless,

it is probably not complete since there are undoubtedly some obscure remarks that have escaped my notice.

Hine (1903) probably made the first recorded observations on an American species in reporting the mating of *Tabanus sulcifrons* Macquart on a rail fence in Ohio. For two successive years he watched pairs copulating on the fence at the south edge of a woods on a clear warm day in mid-August. Mating occurred only between 8:00 and 8:30 a.m. The males of this species clung to the edges of the rails while the females hung limply with legs and wings motionless. If disturbed (Hine, 1906), the males did all of the flying and went but a short distance before alighting. Nine pairs were taken. He states that copulation never lasted more than ten minutes. Two pairs were preserved in formalin and the digestive system of the female was found upon dissection to contain some hardened blood, which yielded haemin crystals when treated with glacial acetic acid. However, there is no real evidence that a blood meal is essential for the maturation of the eggs of Tabanidae. Several authors have expressed the opinion that blood is not necessary and it is known that the females of some species never annoy domestic animals.[3]

Brimley and Sherman (1907) noted that the males of *Hybomitra cincta* (Fabricius) have a habit of hovering in the air in the same manner as the carpenter-bees of the genus *Xylocopa*.

According to Philip (1931), Cameron saw *Tabanus comastes*[4] in copulation at an elevation of 8,500 feet.

The most graphic accounts of hovering are those concerning *Tabanus americanus* Forster in the Florida Everglades as given by Snyder (1917) and by Mosier and Snyder (1918, 1919). They speak of "roaring flights" of "countless thousands" hovering at tree-top height over openings in the forest canopy. This large species swarms from March 10th to May 24th for 15 to 20 minutes from daybreak to sunrise when the weather is reasonably pleasant. They do not hover on rainy nor on unseasonably cool mornings. These authors took less than six hovering flies, all males, in 1918 since the insects are usually too high to permit ready capture. They were sometimes seen to dart towards one another in flight and then cling in pairs. This suggested to the observers that swarming was a mating phenomenon. Mosier was also very sure that they occasionally flew upside down while hovering. On each of four days during the 1919 season a few flies were dramatically brought down from the hovering swarms by H. S. Barber with a 22 calibre pistol loaded with dust shot. The ten specimens so obtained were all males. In 1918 Mosier reported the hovering of about 200 *Tabanus lineola* Fabricius for eight minutes before dark on May 10th at a height of 5 to 8 feet above a road. He knocked down five of them and all were males.

These same papers also give some reports on the flowers that attract the males and females of various species locally. In addition, they contain notes on seasonal distribution and on other matters pertaining to the biology of the Everglade Tabanidae.

In 1924 Webb and Wells reported on the Tabanidae injurious to

[3]See Hine, 1903, p. 9; 1906, p. 25; Neave, 1912, p. 281; papers by Mosier and Snyder, et at., for statements on this disputed point.

[4]Now *Hybomitra captonis* (Marten), in Philip, 1947.

domestic stock in Antelope Valley, which extends from Nevada into California. ***Tabanus phaenops*** Osten Sacken[5] was found to be abundant and the males were numerous in the grass of swampy areas. The authors saw several crawl down grass culms to drink. In August, matings were observed in a rather dry pasture where the grass was knee-high. About 8:30 a.m. on a warm bright morning two were seen mating approximately eight feet above the ground. They flew rapidly and soon came to rest on a grass stem where they were captured. Between 8:00 and 9:00 a.m. on another day four flies were seen in air all clinging together. In about ten seconds they separated and flew away. Another mating pair came to rest on a grass culm and separated in about a minute and a half. Their observations did not reveal whether mating began in flight or at rest.

Bequaert (manuscript) has sometimes observed males of such North American species as ***Hybomitra lasiophthalma*** (Macquart) and of ***H. epistates*** (Osten Sacken) hovering in Syrphid fashion in woodland openings.

On June 9th and 10th in successive years and in different localities MacCreary (1940) observed mating pairs of ***Chrysops fuliginosa*** Wiedemann between 9:00 and 10:00 a.m. on cat-tails and other emergent vegetation. When disturbed they flew erratically a few yards to another resting place without separating.

Philip (1942) speaks lucidly of the matings of ***Hybomitra metabola*** (MacDonnough) which he observed on the bright warm forenoons of May 1 to 3 in and near his Hamilton, Montana, yard. He saw two meet in air, three feet from the ground, and hover momentarily while coupling. Then the female flew awkwardly to a nearby bush while the male hung inertly beneath. They so remained until taken. Later other males were seen hovering, usually over the lawn and near foundation shrubs. Fourteen specimens were captured. Three other pairs were also taken on the bushes; the males were always suspended limply. Hovering was discontinued just before noon each day and was not observed after May third although the weather remained unchanged.

The observations of Haseman (1943) are especially interesting when we recall those of Hine. Haseman saw ***Tabanus sulcifrons*** Macquart hovering at tree-top level, or about 30 feet. The swarming took place for 20 to 25 minutes after daybreak from July 27th to September 2nd around his Missouri home. At this time of day the light intensity ranged from 3 to 5 foot candles. Only males were hovering. Two were netted from a roof. While the males swarmed, females flew about the lawn and low shrubs. As the days grew shorter the flights started later. More specifically, on July 27th swarming started at 5:30 a.m. and on September 1st it did not begin until just after 6:00 a.m. No flights occurred when the temperature was below 60° F. The hovering was confined to restricted areas.

As the last species decreased in numbers, ***Tabanus giganteus*** DeGeer became more abundant. On September 9th several males of the latter were hovering 3 to 5 feet above the lawn and drive at dusk. These flights continued for about a week and the last males were seen September 15th. On September 9th three males with fully developed testes

[5] *Hybomitra sonomensis* (Osten Sacken) subsp. *phaenops* Osten Sacken (Philip, 1947).

were taken. Females were also captured but no mating was observed. Their flights started about 7:00 p.m. with 30 foot candles of light and lasted for 30 minutes. By this time the light intensity had dropped to an average of three foot candles. They often hovered a few feet from the observer.

Craig (1944) simply refers to the observations of Mosier and Snyder and of Haseman. He expresses the opinion that light intensities alone are probably responsible for the hovering of Tabanidae as well as the morning and evening singing of the Wood Pewee. This review clearly refutes his assumption since the recorded statements of various observers make it obvious that factors other than light are certainly involved. It may be pointed out that, contrary to his belief, hovering has been definitely associated with mating by Surcouf (1921b), Philip (1942), Bailey (1947 and below), and that others have considered a relationship probable. Furthermore, temperature is probably even more decisive than light intensity with the insects. However, a detailed investigation of all the factors involved is greatly to be desired.

This completes the chronological summary of the findings known to me with the exception of my earlier (1947) notes which need no amplification here in the light of the more recent study reported below.

FIELD NOTES

The investigation of the biology of *Tabanus nigrovittatus* Macquart was continued throughout the 1947 season on the saltmarshes of Essex County. Special attention was given to the mating habits of this species and a few more details gleaned from these observations follow.

Although no such mass swarming as we saw at Conomo Point in 1946 was seen this summer, on several occasions small numbers of flies were found hovering. It is probable that they engage in this activity whenever the weather is suitable. Usually it occurs before 9:30 a.m. daylight saving time on fairly bright, mild and calm midsummer days. Only once, namely August 1st, were flies seen hovering at a later hour. This exceptional performance may be attributed to the fact that thunder showers the evening before were followed by a sharp drop in temperature. The thermometer stood at 54° F. at 8:00 a.m. that day and the greenheads hovered until about 11:00 o'clock.

Five mornings proved particularly favorable and on each of them time was spent studying this activity. Hovering flies were watched and efforts made to capture them while engaged in this kind of flight in order to determine their sex. On the following dates the specified numbers, a total of 29 males, were netted individually between 8:30 and 9:30 a.m., except on August 1st when the flies hovered until 11:00 and captures were made from 9:30 to 10:30 a.m.

Date	Place	Capture	Remarks
July 16.....	Crane Marsh, Ipswich	5 males	
July 24.....	Pine Island, Newbury	2 males	Mating also observed.
July 28.....	Pine Island, Newbury	12 males	
July 30.....	Pine Island, Newbury	5 males	Mating also observed.
August 1.....	Pine Island, Newbury	5 males	

The flies were not abundant on any of these mornings and were very difficult to approach while hovering. The morning of July 16th was cool. Blustery breezes and intermittent cloudiness interrupted their activity. When the sun shone and the wind was not too brisk the flies would hover, but as soon as clouds cast their shadows on the marsh the greenheads dropped into the grass. Had the weather been more favorable, swarms of horseflies might have been expected since mid-July is the time when this species is normally at its annual population peak. The data given are scant but, when taken with the statements of the above authors, certainly indicate that hovering is primarily a male activity. The few females in such swarms (Cameron, 1934; Haseman, 1943) were perhaps attracted by the humming flight of the males and were not actually hovering with them. Further amplification is, of course, desirable, although it will be difficult to obtain. However, the difficulty of capturing hovering males of *Tabanus nigrovittatus* may be partly explained, if this is really the situation. One may stand quietly and watch them hover only a few feet away and about 6 to 12 inches above the short, lodged *Spartina patens* (Ait.) Muhlenberg which forms a dense cover at the upper limits of tidal overflow on the saltmarsh. As Surcouf noted for *Tabanus algirus* Macquart, several of this species may also hover in a small area, each maintaining its relative position until disturbed. If interrupted, they swiftly dash first one way and then another, but after such sudden excursions usually return to their original places and head into the wind. If another fly passes near one that is hovering, the latter darts towards it immediately. This frequently sets off a kind of "chain reaction" since the first fly and its pursuer often approach others hovering nearby and these in turn swiftly join the swirling pursuit. The chase is so rapid that the eye soon loses sight of the contestants. However, some appear to drop out of the race and resume their hovering positions. Presumably such excited activity results from the attempt of the hovering male to seize a female that flies close by and attracts his notice. On the other hand, I have once or twice seen a fly at rest on the grass directly beneath one of the hoverers and the latter remained utterly indifferent to the one below. But once the collector attempts to move within net-reach of hovering flies, those resting in the grass invariably rise and dart off ahead of him to disrupt the entire flight pattern in the manner suggested above. Then he must pause until the buzzing flies quiet down and assume their positions again. It is easiest to make a catch by approaching from behind. Since the flies orient themselves towards the direction from which the wind is blowing, one should move upwind swinging at fly after fly until successful. The hoverers are extremely alert and catches are infrequent. If the morning is somewhat cool, or the breeze too brisk, they often drop into the shelter of the grass. When they alight they are almost always facing upwards but they immediately turn around in a leisurely manner and often crawl well down towards the base of the culm. They hover only for brief intervals under these conditions. Since their reactions are slower on such days, they are a little more readily captured.

From my own observations, as well as from those of Surcouf, Cameron, Philip and Bouvier, it is evident that there is a definite

connection between the hovering of male Tabanidae and mating as previously noted. The exact nature of this relationship is not yet clear. Nevertheless, as Mosier and Snyder surmised, it may well be a kind of courtship phenomenon. In my original Conomo Point observations mass hovering and mating were going on simultaneously. As stressed above, both activities were again seen on each of two mornings at Pine Island. Since adult emergence is known to occur as late as August 8th (information based on collected pupa), and probably a few flies continue to emerge until the last of the month, it is not surprising that mating was observed on August 12th. Careful observations were made on four pairs found in copulation on the mornings of July 24th and 30th.

The margin of the saltmarsh near the northwestern edge of Pine Island is fairly dry except after extremely high tides and the fine fox grass forms a thick mat over which it is easy to slide. Therefore, I was able to lie down and crawl to within a foot or less of the mating *Tabanus nigrovittatus* Macquart without disturbing them. In this position my eyes were on the same level with the paired flies. In every case studied the males were quietly posed on a slender grass blade while the females were all rather restless. The male of the first pair under observation was clinging head-up to the tip of a *Spartina patens* leaf while the female was holding onto the same blade facing the turf. She moved actively and now and then vigorously pushed the tip of the male's abdomen with her hind tarsi as if attempting to terminate the union. They had been together for between five and ten minutes when a movement startled them and they disengaged. Although they flew but a short distance, only the female was taken.

On a nearby grass blade another pair was observed and similarly approached. In this case the male faced downward and the female necessarily faced in the opposite direction above him on the grass. She was moving as actively as possible under the circumstances. After watching them for a while, I attempted to take them but again netted only the female. It looked to me as if the male controlled the union and, consequently, had a slight advantage when danger threatened which enabled him to avoid capture. This is especially interesting, since on other occasions the males seem less alert. Several times when inclement weather kept them in the grass, sweeping has resulted in the capture of two, three or more males to every female taken. Some figures from the same part of the Pine Island marsh emphasize this fact. On July 21, 45 females and 130 males; on the 24th, 68 females and 97 males; on the 26th, 22 females and 45 males; and on the 28th only 4 females and 55 males were taken. On two of these mornings there was some hovering, as we have said, and mating was studied on the 24th. But the weather was sufficiently overcast or cool to curtail their activity greatly early in the morning. Under these conditions the males are more sedentary while the females will rise to annoy the intruder unless the weather is very disagreeable.

The positions of members of the third pair differed from the others in one respect. As in all but the second case, the male was clinging head uppermost to the grass blade tip. The female, however, was simply hanging freely beneath him and several times buzzed her wings as if attempting to break away. When I inadventantly alarmed

them, the male flew a short distance, dragging the female along, and came to rest on the grass again. This happened twice. Flies of the fourth pair were in the same relative positions as those first described.

In concluding these remarks, a few other habits of this species may be noteworthy. Like many other Tabanidae, this one is often seen dipping to the water's surface as it flies between the banks of the salt-marsh ditches and canals when the tide is partly out. They may often be found in sunny places on the peaty ditch banks where they appear to be sucking the organic oozes. Two taken under these circumstances were both males. Unlike some species, *Tabanus nigrovittatus* was never observed about any of the flowers which flourished above the high tide line at the edge of the saltmarsh. However, occasional specimens carried anthers, probably of the marsh grasses, on their tarsi. We still have much to learn about the biology of this common species.

SUMMARY

This paper brings together the observations of a score of workers concerning mating and associated activities of Tabanidae. Such fragmentary notes record actual mating for only thirteen species distributed in the following six genera: *Chrysops*, 3; *Chrysozona*, 2; *Hybomitra*, 2; *Silvius*, 1; *Tabanus*, 4; and *Therioplectes*, 1. In only four instances are more than the barest details stated. Nine authors are responsible for the 13 cases cited. With the exception of *Chrysozona denshami* (Austen), which is said to mate at nightfall in the Belgian Congo, and *Tabanus auropunctatus* Macquart of Algeria that mates in mid-afternoon, all species noted mate between 8:00 a. m. and noon. Fifteen writers have described, more or less fully, the hovering habits of 19 species in the following five genera: *Chrysozona*, 2; *Hybomitra*, 4; *Pangonia*, 1; *Tabanus*, 10; and *Therioplectes*, 2. Two of these, *Tabanus lineola* Fabricius and *T. giganteus* DeGeer, hover at dusk. The rest hover from dawn until sunrise or during the forenoon. Mating appears to be initiated in the air and is usually completed at rest on nearby vegetation. The evidence indicates that the swarming flight and hovering are of significance in the mating of certain Tabanidae. Original observations on the hovering and mating of *Tabanus nigrovittatus* Macquart are included. Twenty-nine males were captured individually while hovering. When added to the data of other observers, this indicates that hovering is primarily a male activity. This species dips to the surface of the water in the saltmarsh ditches. Two males were taken on the peaty bank of a ditch where they appeared to be suck ıg in the oozes. *T. nigrovittatus* is never seen near the flowers which bloom profusely at the border of the saltmarsh.

LITERATURE CITED

Bailey, N. S. 1947. Field Notes on *Tabanus nigrovittatus* Macquart. Psyche, 54 (1): 62–64.

Bequaert, J. C. (Manuscript notes on biology of Tabanidae.)

Bouvier, G. 1945. Les Tabanidés de la Suisse. Mitt. Schweizer Ent. Ges., 19 (10): 449, 453–454.

Brauer, F. 1880. Die Zweiflügler des kaiserlichen Museums zu Wien. I., Akad. Wiss. Wien, Denkschr., 42: 185.

Brimley, C. S., and **Sherman, F., Jr.** 1908. Additional records of Tabanidae (Horse Flies) of North Carolina. Ent. News, 19: 172.
Buxton, P. A. 1924. Applied entomology of Palestine, being a report to the Palestine Government. Bull. Ent. Res., 14: 289.
Cameron, A. E. 1934. The life history and structure of *Haematopota pluvialis* Linné. Trans. Roy. Soc. Edin., 58, Part 1 (10): 213–214.
Craig, Wallace. 1944. The twilight ceremonies of horseflies and birds. Science, 99: 125–126.
Goffe, E. R. 1931. British Tabanidae. Trans. Ent. Soc. S. Eng., 6: 46.
Haseman, Leonard. 1943. The courting flights of tabanids. Science, 97 (2517): 285–286.
Hine, James S. 1903. Tabanidae of Ohio. Ohio Acad. Sci., Special Paper 5, p. 8.
1906. Habits and life histories of some flies of the family Tabanidae. U.S.D.A. Bur. Ent. Tech. Ser. No. 12, Part 2, p. 24.
Jones, H. P. 1922. Some notes on the habits of male Tabanidae. Entomologist 55: 40–42.
Kirkpatrick, T. W. 1918. Diptera in 1917. Ent. Mo. Mag., 54: 18.
MacCreary, Donald. 1940. Report on the Tabanidae of Delaware. Del. Agr. Exp. Sta. Bull. 226: 17.
Mosier, C. A., and **Snyder, T. E.** 1918. Further notes on Tabanidae in the Florida Everglades. Ent. Soc. Wash., Proc., 20(6): 115–126.
1919. Notes on the seasonal activity of Tabanidae in the lower Everglades of Florida. Ent. Soc. Wash., Proc., 21(8): 186–196.
Neave, S. A. 1912. Notes on the blood-sucking insects of eastern tropical Africa. Bull. Ent. Res., 3(3): 279–299.
1915. The Tabanidae of Southern Nyasaland with notes on their life-histories. Bull. Ent. Res., 5(4): 287–332 (see p. 297).
Philip, C. B. 1931. The Tabanidae (Horseflies) of Minnesota. Minn. Agr. Exp. Sta. Tech. Bull. 80, p. 43.
1942. Mating of the horsefly *Tabanus metabolus*. Bull. Brook. Ent. Soc., 37(3): 106.
1947. A catalog of the blood-sucking fly family Tabanidae (horseflies and deerflies) of the Nearctic Region north of Mexico. Amer. Midl. Nat., 37(2): 257–324.
Snyder, T. E. 1918. A peculiar habit of a horsefly (*Tabanus americanus*) in the Florida Everglades. Ent. Soc. Wash., Proc., 19: 141–145.
Surcouf, J. M. 1921a. Tabanidae, *in Genera Insectorum*, Fasc. 175, p. 17, and 1921b. Tabanidae, *in Genera Insectorum*, Fasc. 175, Supplement, p. 190.
Verrall, G. H. 1909. British Flies, Vol. V, London, p. 321.
Webb, J. L., and **Wells, R. W.** 1924. Horseflies: Biologies and relations to western agriculture. U.S.D.A. Bull. No. 1218, p. 23.

LIST OF RECORDED COTTON INSECTS OF THE WORLD, by H. HARGRAVES. 50 pages. Commonwealth Institute of Entomology, London. 1948.

This work is intended to serve as a quick and easy reference to the names of all mites and insects recorded from cotton, the chief source of the compilation being volumes one to thirty-four inclusively of the Review of Applied Entomology. The insects are listed by order and, except for the minor orders, by family; the information given, covers the part or parts of the plant attached and the country or countries from which the species in question has been recorded from cotton. Forty concentrated pages are devoted to this material; all but six of these deal with Coleoptera, Lepidoptera, and Hemiptera (Heteroptera and Homoptera). There is a brief list of representative literature, an index to families and genera, and a geographical index.

The usefulness of this work in the United States is suggested by the item in the geographical index: "U. S. A., on every page with the exception of pp. 20 and 24." We note a Mexican record on page 24. A brief citation of authorities for the records would have added much to its value, but would also have increased the size of the paper.—M.T.J.

LARVAE OF SOME GENERA OF CALENDRINAE (= RHYNCHOPHORINAE) AND STROMBOSCERINAE

(Coleoptera: Curculionidae)

W. H. ANDERSON

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration,
United States Department of Agriculture

The Calendrinae is that group of weevils to which belong the various billbugs, the granary and rice weevils, the banana root borer, and other less well known species. Larvae of the group have been the subjects of published, comprehensive studies by two authors. In 1924 Cotton treated the larvae of nine of the ten genera known to be established in America north of Mexico, presenting a key together with brief but adequate characterizations of the genera and carefully prepared illustrations. In 1934 and again in 1938 Gardner published keys and descriptions for the identified larvae of the species occurring in India. His fully illustrated papers also include keys to the larger groups of weevils, in so far as they were represented. There are several other papers which include descriptions or carefully prepared figures of larvae of the group, but they treat only one or a few species. These papers are listed in the bibliography. Since the appearance of Cotton's paper larvae of additional genera have become available for study, some from Central and South America, others from the islands of the Pacific Ocean. It is with the intention of making those larvae recognizable and indicating their position in a classification of the group based upon larval characters that this paper is prepared.

With the exception of the specimens of *Diathetes pandanae* Zimmerman and *D. lyriger* Marshall, which were kindly loaned to me by E. C. Zimmerman, Bernice P. Bishop Museum, Hawaii, the larvae described herein are in the collection of the United States National Museum. All the larvae studied are mature or nearly mature. The generic placement of all the larvae and nearly all the specific identifications can be considered as established beyond a reasonable doubt through rearing and identification of the adults by competent authorities.

Gardner, in 1934, treated the Calendrinae, Sipalinae based upon *Sipalus*, and Stromboscerinae based upon (*Xerodermus*) = *Orthosinus*, as separate although related subfamilies. In 1938 he considered the three groups as tribes of the Calendrinae. On the basis of the characters which will be pointed out below, I believe he is correct in considering *Sipalus* and its relatives as a group subordinate in importance to the Calendrinae. In my opinion, however, the Stromboscerinae[1] are sufficiently distinct to be treated as a separate subfamily, although

[1]The concepts of the Sipalini and of the Stromboscerinae, in the sense as used in the present paper, are based upon the material available for study.

I believe the relationship between the two groups, Calendrinae and Stromboscerinae, close enough to make it advisable to treat them in the same paper. It is believed that the combination of characters given below will serve to distinguish these two subfamilies from all others of which larvae are known.

Antenna consisting of one membranous article which bears a conical to subconical (rarely flattened and disc-shaped or subglobular) accessory sensory appendage[2] and several minute setae. Catapophyses in same plane as frons. Frontal suture usually distinguishable throughout its length, incomplete anteriorly. Epicranium with five dorsal, two lateral, two ventral, and four posterior setae. Frontal seta 5 subequal to or longer than frontal seta 4. Anterior margin of labrum rounded or slightly produced in the middle. Labrum with three pairs of setae and a pair of anterior sensilla which lie between the bases of labral rods (at extreme anterior margin of labrum in Stromboscerinae). Labral rods well developed, subparallel or convergent, often connected posteriorly. Some dorsal setae on mala commonly but not always branched. Typical abdominal segments with three or four dorsal folds. Well-developed spiracles present on abdominal segment VIII, dorsal in position and oriented so that the air tubes, when present, are directed strictly posteriad. Spiracles of typical abdominal segments vertical in orientation, i.e., the air tubes, when present, directed dorsad. Orifice of spiracles nearly always an elongate slit with subparallel margins. Spiracular area of typical abdominal segments with two setae. Pleurum subdivided into two or more lobes, one of which nearly always bears two setae, the subdivision incomplete in *Dryophthorus* and *Stenommatus*.

One of the more important diagnostic characters for larvae of these two subfamilies, as given above, is found in the orientation of the abdominal spiracles. An identical orientation, except on abdominal segment VIII, is found in known larvae of the Cholinae and in most of the known larvae of the Hylobiinae. The orifice of the spiracles on larvae of the Cholinae and most of the larvae of the Hylobiinae is an elongate slit, a condition found in nearly all the larvae of the Calendrinae and the Stromboscerinae. However, the air tubes of the spiracles on abdominal segment VIII are directed dorsad in larvae of the Cholinae and larvae of most of the genera of the Hylobiinae. Three genera placed or retained in the Hylobiinae by Marshall (1932)—namely, *Sternechus*, *Anchonus*, and *Heilipus*—contain larvae which differ from those of the other genera of the subfamily in that the spiracles on the abdominal segments are oriented so that the air tubes are directed nearly posteriad.

As has been indicated above, the Calendrinae and Stromboscerinae are considered to be closely related on the basis of characters of their larvae. On the other hand they are distinguishable at once by means of the characters expressed in the following couplet.

Frons with five pairs of setae (fig. 15); posterior pair of setae on postmentum separated by a distance less than one-half as great as that between those of middle pair (fig. 11); postdorsum of mesothorax and metathorax with three (*Sitophilus*) or four setae; (spiracles on middle abdominal segments nearly always distinct and readily discernible (fig. 17))... **Calendrinae** (p. 415)

[2]For an explanation of this and other terms see Anderson (1947).

Frons with four pairs of setae (fig. 14); posterior pair of setae on postmentum separated by a distance subequal to that between those of middle pair (fig. 10); postdorsum of mesothorax and metathorax with two setae; (spiracles on middle abdominal segments nonfunctional, scarcely discernible (fig. 9)),
Stromboscerinae (p. 434)

Subfamily **Calendrinae**

Frons with five pairs of setae. Posterior pair of setae on postmentum separated by a distance which is one-third to one-half as great as that between setae of middle pair. Postdorsum of mesothorax with three or four setae. Pleurum of typical abdominal segments subdivided into three or more lobes.

Larva usually robust, small to large, subcircular in cross section, usually distinctly thicker through middle abdominal segments, with abdominal segments VIII and IX often flattened dorsally. Head free or partially retracted into prothorax, as long as or longer than broad, not emarginate posteriorly. Anterior ocellus present, usually moderately distinct; posterior ocellus absent. Clypeus with two setae and sensillum on each side near base. Epipharynx usually with six anteromedian setae and four median spines. Accessory sensory pores nearly always discernible on epipharynx. Epipharynx usually with distinct asperities. Mandible with one or two teeth. Two setae present on outer surface of mandible. Labial palpus with two articles. Ligula with four setae. Premental sclerite present, complete. Asperities often present on dorsal surface of mala.

Thoracic spiracle usually bicameral, rarely without air tubes. Spiracular area of mesothorax with one to four setae. Alar area with one or two setae. Pedal area with five to seven setae.

Typical abdominal segments with three or four dorsal folds. Prodorsal seta (rarely, *Rhinostomus*, more than one) present on typical abdominal segments. Pedal area distinguishable, with one seta. Eusternum with two setae. Anus usually ventral and anterior to posterior end of body, rarely terminal, never subdorsal. Asperities usually discernible, rarely hook shaped and large (*Cactophagus*).

With a few exceptions, most of which are in the Sipalini, larvae of the Calendrinae attack living herbaceous plants, largely grasses, although larvae of several genera attack living palms. Larvae of the Sipalini attack dead or dying plants, including dead trees.

KEY TO TRIBES OF CALENDRINAE

1. Abdominal segment VI abruptly smaller than segment V (fig. 1); branched setae on epipharynx (fig. 2) and on dorsal surface of mala tuftlike,
Sipalini (p. 416)

   Abdominal segment VI only slightly or not smaller than segment V (fig. 17); setae on epipharynx (figs. 3 to 6) and on dorsal surface of mala simple or branched, not tuftlike 2

2. Epipharynx with three or more than three anterolateral setae, some of the setae often branched (figs. 3 to 5); sensilla on epipharynx developed as pores (fig. 3) (except *Myocalandra*); postdorsum of mesothorax and metathorax with four setae; larva usually moderately large to large, not infesting seeds 3

   Epipharynx with two, simple anterolateral setae (fig. 6); sensilla on epipharynx very small, peglike (fig. 6); postdorsum of mesothorax and metathorax with three setae; larva small, subglobular, infesting seeds and nuts ..... **Sitophilini** (p. 432)

3. Epipharynx with five or more than five simple anterolateral setae (fig. 5); mala with twenty to thirty dorsal setae; spiracles without air tubes; five postdorsal setae present on typical abdominal segments,
Rhynchophorini (p. 418)

Epipharynx with three anterolateral setae, the setae often branched (figs. 3, 4); mala with eight or rarely ten dorsal setae; spiracles bicameral (figs. 18, 19); three or four postdorsal setae present on typical abdominal segments.....**Calendrini** (p. 419)

Tribe **Sipalini**

Epipharynx with four to ten anterolateral setae, some of the anterolateral and the anteromedian setae tuftlike. One epipharyngeal sensory pore present on each side, each pore surrounded by a sclerotized ring. Mala with ten to thirteen dorsal setae, at least some of which are tuftlike. Asperities long and dense on dorsal surface of mala (evidently absent on *Sipalus*). Mesothorax and metathorax with four postdorsal setae. Five postdorsal setae present on typical abdominal segments. Sternellum present. Anus ventral, in front of posterior end of body. Abdominal segments VIII and IX with a cylindrical to subcylindrical process from each lateral margin, each process on segment VIII with two setae at the tip, each process on segment IX with three setae.

Larva moderately small to large, increasing in thickness rather gradually from prothorax to abdominal segment V then abruptly smaller and declivous through abdominal segments VI to IX. Head light orange, without distinguishable less heavily pigmented areas dorsally, partially retracted into prothorax. Endocarina absent. Paired basal sensilla present on labrum. Distinct asperities present on epipharynx. Ligula moderately produced, bearing one pair of tuftlike setae, the second pair branched or simple. Mala with three or four ventral setae.

Thoracic spiracle with or without air tubes. Spiracular area of mesothorax with three setae. Alar area with two short to very short setae. Pleurum of mesothorax and metathorax not subdivided, each area with one seta.

Setae on spiracular area of typical abdominal segments very short, subequal. Pleurum subdivided into four or five lobes. Asperities present and very fine or not discernible.

The larva of *Sipalus hypocrita* Boh., as described by Gardner (1934), appears to agree with the above characterization in most of the essential details, such as the abrupt reduction in size of the body behind abdominal segment V, the tuftlike setae on epipharynx and dorsal surface of mala, and the presence of fleshy processes from abdominal segments VIII and IX. It is evident that *Sipalus*, *Rhinostomus* and *Yuccaborus* form a natural, compact group. On the other hand, larvae of *Sipalus hypocrita* can be separated from larvae of the other two genera by the fact that there are two pairs of processes on posterior margin of abdominal segment IX in *Sipalus* whereas there is only one pair on larvae of *Rhinostomus* and *Yuccaborus*.

The relationships of *Anius* to the other Sipalini are not so evident, judging from the description of the larva of *Anius pauperatus* Pascoe by Gardner (1938). The figures of that larva (Gardner 1938, figs.

65–71) do not show an abrupt decrease in size of the body behind abdominal segment V, there are only three anterolateral setae on epipharynx and all epipharyngeal setae are simple, setae on dorsal surface of mala are fewer in number and branched but not tuftlike, and spiracles on abdominal segments II to VI are vestigial. The enumerated important characters indicate not only that *Anius* is not closely related to the other Sipalini, but rather that it approaches the Stromboscerinae as characterized below (see p. 434). Until its larva can be restudied in the light of the present interpretation of the importance of the various characters, it will be best to leave the relationships of *Anius* in question.

KEY TO GENERA OF SIPALINI

Sclerite on pronotum with red, irregular, transverse rugae near the posterolateral margins; epipharynx with ten tuftlike anterolateral setae (fig. 2), ... I. **Rhinostomus** (p. 417)

Sclerite on pronotum scarcely pigmented, without rugae near the posterolateral margins; epipharynx with four to six anterolateral setae, the more anterior setae tuftlike ..... II. **Yuccaborus** (p. 418)

I. Genus **Rhinostomus** Rafinesque, 1815[3]

(Fig. 2)

Sclerite on pronotum orange, with red, irregular, transverse rugae near the posterolateral margins; smaller rugose areas present on spiracular areas of mesothorax and metathorax. Accessory sensory appendage of antenna rudimentary, consisting of a small flattened disc. Labral seta 2 short, tuftlike. Epipharynx with ten tuftlike, anterolateral setae. Thoracic spiracle elliptical, without air tubes. Abdominal spiracles without air tubes. Four prodorsal setae present on abdominal segments I to V.

Larva large. Lateral margins of head slightly convergent posteriorly, the posterior margin nearly transverse, shouldered on the ventral side. Ocellus moderately large, weakly convex. Labral rods nearly straight, subparallel, not connected posteriorly. Asperities on epipharynx laterally and in two lines between the labral rods, elongate, hairlike. Prementum covered with a pigmented sclerite, the anterolateral margins of which are heavily sclerotized. Mala with one of the ventral setae short, simple, the three posterior dorsal setae simple or with a few branches, the remaining setae tuftlike.

Principal areas on thoracic segments with orange sclerites. Spiracular area of mesothorax with two of the setae short to moderately long, the other seta very short. Mesothorax and metathorax with postdorsal setae short, subequal.

Spiracles on abdominal segments I to V narrow slits, subequal in size, those on segments VI and VII slightly larger, subdorsal, those on segment VIII elliptical. Typical abdominal segments with four dorsal folds. Pleurum subdivided into five lobes on abdominal segments II to V. Pleurum with three setae, two located on the second lobe from dorsum, the third seta on either the third or fourth lobe. Asperities not discernible.

[3]Rafinesque proposed the name *Rhinostomus* to replace *Rhina* Latreille, 1802, which was preoccupied by *Rhina* Schaeffer, 1760, in fish.

Width of head: 5.5 mm. to 6 mm.

R. barbirostris (F.). Dominican Republic, in cocoanut palm. Honduras, February 1, 1917, in cocoanut palm, E. M. Anderson. Bahia, Brasil, G. Bondar.

II. Genus **Yuccaborus** Leconte, 1876

(Fig. 1)

Sclerite on pronotum scarcely pigmented, the remainder of body without pigmented areas. Accessory sensory appendage of antenna small, conical. All labral setae simple. Epipharynx with four to six anterolateral setae, the more anterior setae tuftlike. Thoracic spiracle bicameral, the air tubes without annulations, approximately one-third as long as elliptical peritreme. Spiracles on abdominal segments I to VII very small, with peritreme vague and with one or two poorly developed air tubes. One prodorsal seta present on abdominal segments.

Larva moderately small. Lateral margins of head smoothly rounded, oval posteriorly, not shouldered. Ocellus small, indistinct. Labral rods slightly arcuate, subparallel, connected posteriorly by a transverse bridge. Asperities sparse laterally on epipharynx, elongate and dense between the labral rods. Premental sclerite with slender anterior and posterior median extensions. Mala with three of the ventral setae simple, the remaining ventral and all dorsal setae with numerous branches.

Setae on spiracular area of mesothorax very short. Mesothorax and metathorax with postdorsal setae 1, 2 and 4 very short, 3 short.

Typical abdominal segments with three dorsal folds, fold I not distinguishable laterally. Pleurum subdivided into four lobes on abdominal segments II to V, the second lobe with two setae. Asperities very fine, generally distributed over whole body.

Width of head: 3 mm. to 3.2 mm.

Y. lentiginosus Csy. Ten miles northeast of Brownsville, Texas, June 4, 1904, in *Yucca*, larvae in galleries between bark and interior, the galleries similar to those of *Dendroctonus*, H. S. Barber.

Tribe **Rhynchophorini**

Body coarsely wrinkled, the wrinkles longitudinal, somewhat irregular. Frons with four subparallel, longitudinal grooves. Labrum with paired basal sensilla. Epipharynx with five or more than five anterolateral setae, the setae simple. Epipharyngeal sensory pores present. Mala distally truncate, with two ventral and twenty to thirty dorsal setae, the posterior dorsal setae placed at random, some of the dorsal setae bifurcate. Thoracic spiracle a simple, curved slit without air tubes. Postdorsum of mesothorax and metathorax with four setae. Pleurum of mesothorax and metathorax subdivided into three lobes, the middle lobe with a moderately long seta. Typical abdominal segments with five postdorsal setae. Posterior margin of abdominal segment IX with two pairs of broadly rounded projections. Asperities fine, dense, giving the appearance of a velvety coat, except on sclerotized areas.

Larva large, robust. Pronotum with paired reddish-brown sclerite.

Smaller reddish-brown sclerites on several body areas. Head dark brown, with subparallel, less heavily pigmented stripes dorsally. Endocarina absent. Ocellus absent or indistinct. Antenna small, completely surrounded by lateral portion of frons, directed laterad. Labral setae simple. Asperities present laterally on epipharynx and between the rods, particularly long and dense posteriorly between the rods. Ligula somewhat produced, apically truncate, the setae simple. Premental setae simple. Postmentum covered with light orange sclerite.

Spiracular area of mesothorax with three short to very short setae. Alar area with one short seta.

Abdominal spiracles without air tubes, those on segments I to VII small, near anterior margin of segment. Setae on spiracular area short to very short. Epipleurum subdivided into two poorly defined lobes, each lobe with one short seta. Sternellum and poststernellum present. Anus ventral, in front of posterior end of body.

The genera *Dynamis* and *Rhynchophorus* are doubtfully distinct on the basis of the observed characters of their larvae, and the differences indicated below are probably of no more than specific importance. For this reason no key to the two genera is presented.

III. Genus **Dynamis** Chevrolat, 1883

Prodorsum of mesothorax and metathorax with paired sclerite. Epipharynx with five or six anterolateral setae. Mala with twenty to twenty-two dorsal setae, the dorsal surface of mala without obvious asperities about the bases of anterior setae. Thoracic spiracle not obviously curved.

Width of head: 9 mm. to 10 mm.

D. borassi (F.). Ecuador, May 13, 1924, palms, F. Campos R., received through H. Morrison.

IV. Genus **Rhynchophorus** Herbst, 1795

(Fig. 5)

Prodorsum of mesothorax and metathorax without sclerites. Epipharynx with nine to thirteen anterolateral setae. Mala with twenty to thirty dorsal setae, obvious asperities usually present about the bases of anterior dorsal setae. Thoracic spiracle obviously curved.

Width of head: 7.5 mm. to 10.2 mm.

R. cruentatus (F.). Several lots of larvae, all from Florida, usually in cabbage palmetto.

R. palmarum (L.). Tumaco, Colombia, 1912, destroying cocoanut trees, G. H. Williams. "Juan Diaz," Venezuela, March, 1918, from cocoanut trunk, H. Pittier.

Tribe **Calendrini**

Epipharynx with three anterolateral setae, none of the epipharyngeal setae tuftlike. Epipharyngeal sensory pores present. Mala with eight or rarely ten dorsal setae, at least some of the dorsal setae usually branched but not tuftlike. Thoracic spiracle bicameral. Postdorsum of mesothorax and metathorax with four setae. Three or four post-

dorsal setae present on typical abdominal segments. Posterior margin of abdominal segment IX with four pairs of readily discernible setae.

Larva usually moderately large, slender to moderately robust. Posterior margin of abdominal segment IX with or without projections. Head usually distinctly pigmented and with dorsal, less heavily pigmented stripes. Endocarina usually present. Labral seta 2 often branched. Labrum with one basal sensillum or a pair of basal sensilla. Epipharynx with distinct asperities. Ligula with or without asperities. Postmentum usually partially covered with vague to distinct sclerite. Mala with three to five ventral setae. Dorsal surface of mala nearly always with elongate asperities among the setae.

Alar area of mesothorax and metathorax with one or two setae. Pleurum of mesothorax and metathorax not subdivided, each with one seta.

Typical abdominal segments with three or four dorsal folds. Sternellum present. Anus usually ventral, in front of posterior margin of segment IX, rarely subterminal. Asperities usually inconspicuous, rarely strong and hook shaped.

KEY TO GENERA OF CALENDRINI

1. Abdominal segments I to VII without discernible spiracles (*Polytus*) or the spiracles very small, without discernible air tubes (*Cosmopolites*); seta on epipleurum of metathorax distinctly shorter than on epipleurum of mesothorax 2

   Abdominal segments with spiracles present, occasionally small (*Myocalandra*) but then the air tubes well developed; seta on epipleurum of metathorax subequal in length to that on epipleurum of mesothorax (fig. 17) 3

2. Abdominal segments I to VII with spiracles, the spiracles small, without discernible air tubes; thoracic spiracle elongate, curved, the air tubes approximately one-fifth as long as peritreme (fig. 19); typical abdominal segments with three postdorsal setae ..... V. **Cosmopolites** (p. 421)

   Abdominal segments I to VII without discernible spiracles; thoracic spiracle not curved, the air tubes distinctly longer than subtriangular peritreme (fig. 18); typical abdominal segments with four postdorsal setae ..... VI. **Polytus** (p. 422)

3. Asperities present and distinct laterally on epipharynx (fig. 4), rather short in *Diathetes:* accessory sensory pores of epipharynx not situated between the labral rods, nearly always clearly outside the rods (fig. 4) 4

   Asperities absent lateral to rods on epipharynx (fig. 3); accessory sensory pores (peglike in *Myocalandra*) of epipharynx situated between the rods (fig. 3) 12

4. Dorsal surface of mala without asperities among the setae; endocarina absent; labrum with a pair of basal sensilla (as in fig. 7); all setae on epipharynx simple; dorsal setae on mala branched. . VII. **Diathetes** (p. 424)

   Dorsal surface of mala with asperities among the setae; with a different combination of the remaining characters 5

5. Posterior margin of abdominal segment IX with a pair of projections which are longer than broad (fig. 16) 6

   Posterior margin of abdominal segment IX usually without projections, occasionally with a pair of broad and truncate or short and bluntly conical projections 7

6. Each projection from posterior margin of abdominal segment IX bearing two elongate setae; setae on dorsal surface of mala simple, VIII. **Phacecorynes** (p. 424)

   Each projection from posterior margin of abdominal segment IX bearing three elongate setae (fig. 16); setae on dorsal surface of mala branched, IX. **Scyphophorus** (p. 425)

7. Posterior margin of abdominal segment IX with three pairs of elongate setae; length of air tubes of thoracic spiracle nearly twice as great as length of subtriangular peritreme.....X. **Trochorhopalus** (p. 426)
   Posterior margin of abdominal segment IX with four pairs of elongate setae; length of air tubes of thoracic spiracle subequal to or distinctly shorter than length of peritreme..... 8
8. Body with stout, hook-shaped asperities arranged in rather regular rows, XI. **Cactophagus** (p. 426)
   Body without stout asperities, the asperities finer and not arranged in rows..... 9
9. All setae on mala simple; all epipharyngeal setae simple; length of air tubes of thoracic spiracle subequal to that of subtriangular peritreme, XII. **Rhodobaenus** (p. 427)
   All dorsal setae or at least more than half the dorsal setae (some species of *Calendra*) on mala branched; at least one pair of anteromedian setae on epipharynx branched; length of air tubes of thoracic spiracle usually distinctly shorter than that of peritreme.....10
10. Labrum with a pair of basal sensilla (fig. 7); asperities on anterior half of prodorsum of abdominal segment I inconspicuous, not obviously stouter than those on the neighboring areas of the body; (eusternal setae on abdominal segment VIII usually short to very short, usually scarcely discernible).....XIII. **Calendra** (p. 427)
    Labrum with one basal sensillum (fig. 8); asperities on anterior half of prodorsum of abdominal segment I conspicuous, occasionally pale, obviously stouter than those on the neighboring areas of the body; (eusternal setae on abdominal segment VIII usually moderately long, readily discernible).....11
11. Posterior margin of abdominal segment IX smoothly rounded or transverse; ligula with asperities (fig. 13).....XIV. **Metamasius** (p. 429)
    Posterior margin of abdominal segment IX with a distinct, smoothly excavated emargination; ligula without asperities (fig. 12), XV. **Rhabdoscelus** (p. 430)
12. Typical abdominal segments with three postdorsal setae; anterior dorsal setae on mala simple; (mala without discernible asperities dorsally; pronotum with transverse band of asperities along posterior border), XVI. **Myocalandra** (p. 430)
    Typical abdominal segments with four postdorsal setae; anterior dorsal setae on mala branched; (mala usually with long or short asperities dorsally; pronotum without transverse band of asperities, with or without median longitudinal band of asperities).....13
13. Anterolateral setae on epipharynx branched (fig. 3); one pair of setae on ligula branched (fig. 11); pronotum with median longitudinal band of pale asperities.....XVII. **Eucalandra** (p. 431)
    Anterolateral setae on epipharynx simple; setae on ligula simple; pronotum without median band of asperities.....XVIII. **Diocalandra** (p. 431)

V. Genus **Cosmopolites** Chevrolat, 1885

(Fig. 19)

Frontal seta 4 short to very short, seta 5 long. Labrum with one basal sensillum. Mala with five ventral and ten dorsal setae, the posterior seta on ventral surface and the nine posterior setae on dorsal surface branched. Air tubes of thoracic spiracle one-third to one-fifth as long as elliptical, often curved, peritreme. Alar area with one very short seta. Seta on epipleurum of metathorax usually distinctly shorter than that on epipleurum of mesothorax, the seta on pleurum of mesothorax and metathorax long. Spiracles on abdominal segments I to VII very small, with air tubes and peritreme scarcely discernible. Typical abdominal segments with three postdorsal setae. Posterior margin of abdominal segment IX without projections.

Larva moderately large, slightly thicker through abdominal segments

IV, V and VI. Head light orange, with narrow, short, nonpigmented stripes dorsally, free, longer than broad, the sides subparallel, rounded posteriorly. Endocarina present, one-third to one-half as long as frons. Labral seta 2 branched. Labral rods united posteriorly. Epipharynx with the anterolateral and two pairs of anteromedian setae branched. Asperities on epipharynx moderately conspicuous laterally and between the labral rods, in evident tufts about the base of all anterior setae. Ligula not produced, without asperities. Mala with asperities on dorsal surface along the line of setae.

Spiracular area of mesothorax with one very short seta.

Typical abdominal segments with setae of spiracular area very short. Pleurum indistinctly subdivided into three lobes. Asperities inconspicuous, sparsely distributed dorsally and ventrally on abdominal segments III to V.

Width of head: 2.7 mm. to 3.2. mm.

C. sordidus (Germ.). Numerous larvae from Florida, the West Indies, and several groups of islands of the Pacific Ocean, all from trunks or base of roots of banana. Almirante, Panama, December 1947, Manila hemp (*Musa textilis*), submitted through E. J. Hambleton.

VI. Genus **Polytus** Faust, 1895

(Fig. 18)

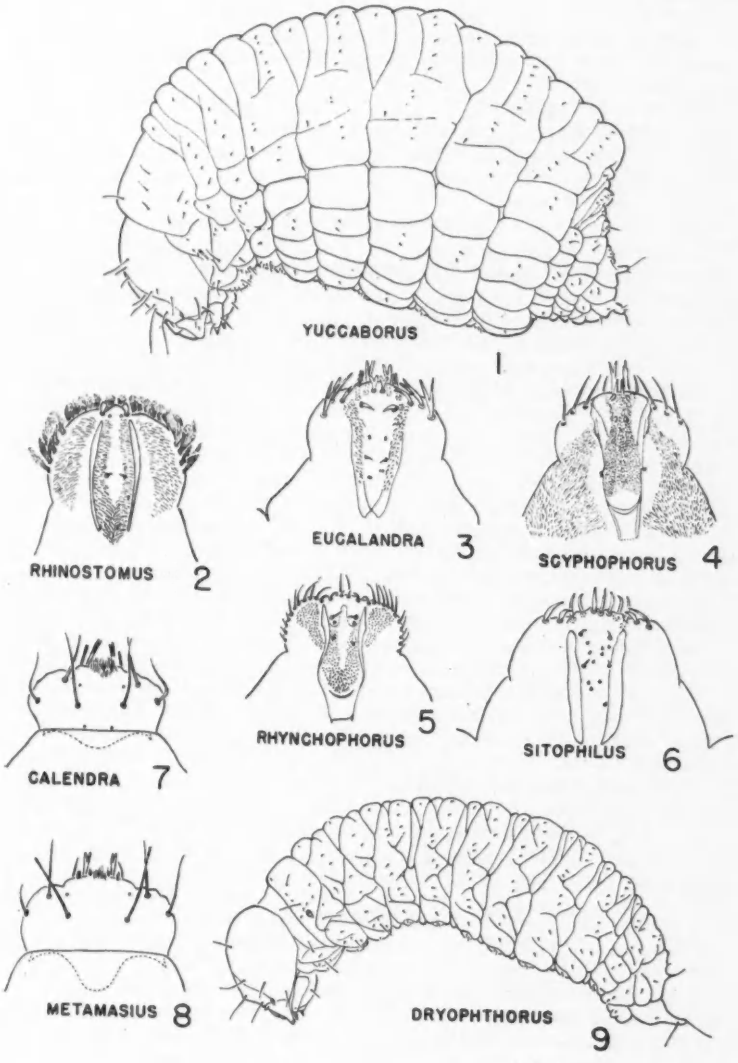
Frontal setae 4 and 5 long, subequal. Labrum with one basal sensillum. Mala with five ventral and eight dorsal setae, one ventral seta and all dorsal setae branched. Air tubes of thoracic spiracle distinctly longer than short, triangular peritreme. Alar area with one minute seta. Seta on epipleurum of metathorax and on pleurum of mesothorax and metathorax minute, the seta on epipleurum of mesothorax long. Spiracles on abdominal segments I to VII not discernible. Typical abdominal segments with four postdorsal setae. Posterior margin of abdominal segment IX without projections.

Larva comparatively slender, small, of nearly equal thickness throughout. Head light orange, with broad, vaguely defined less heavily pigmented stripes dorsally, free, slightly longer than broad, the lateral margins subparallel, broadly rounded posteriorly. Endocarina present, vague, approximately one-third as long as frons. Labral setae simple. Labral rods straight, convergent but not connected posteriorly. Epipharynx with two pairs of anteromedian setae branched near apex, the remaining setae simple. Asperities fine and sparse laterally on epipharynx, more dense and elongate between the labral rods. Inner surface of mandible, near base, with a prominent, triangular tubercle.

EXPLANATION OF PLATE I

(All figures drawn by author)

Fig. 1. *Yuccaborus lentiginosus* Csy., lateral view of larva, × 8. Fig. 2. *Rhinostomus barbirostris* (F.), epipharynx, × 20. Fig. 3. *Eucalandra setulosa* (Gyll.), epipharynx, × 75. Fig. 4. *Scyphophorus acupunctatus* Gyll., epipharynx, × 30. Fig. 5. *Rhynchophorus palmarum* (L.), epipharynx, × 40. Fig. 6. *Sitophilus rugicollis* (Csy.), epipharynx, × 165. Fig. 7. *Calendra ludoviciana* (Chttn.), labrum, × 30. Fig. 8. *Metamasius* sp., probably *anceps* (Gyll.), labrum, × 30. *Dryophthorus distinguendus* Perkins, lateral view of larva, × 20.


YUCCABORUS
1
RHINOSTOMUS
2
EUCALANDRA
3
SCYPHOPHORUS
4
RHYNCHOPHORUS
5
SITOPHILUS
6
CALENDRA
7
METAMASIUS
8
DRYOPHTHORUS
9

Ligula not produced, with asperities. Mala with elongate asperities on dorsal surface.

Spiracular area of mesothorax with one minute seta.

Typical abdominal segments with setae of spiracular area very short to minute. Pleurum indistinctly subdivided into three lobes. Asperities not discernible.

Width of head: 0.7 mm.

P. mellerborgi (Boh.). Manila, P. I., November 26, 1915, in banana plants infested by *Cosmopolites sordidus*, D. B. Mackey. Honolulu, T. H., March 27, 1935, ex banana corm, O. H. Swezey.

VII. Genus **Diathetes** Pascoe, 1874

Posterior margin of abdominal segment IX broadly emarginate, with a pair of short but distinct, bluntly conical projections, each projection bearing one seta at apex and another seta on ventral side at base. Endocarina absent, the apical angle of frons with a distinct pit. Labrum with a pair of basal sensilla. Asperities present but short and sparse laterally on epipharynx. Accessory sensory pores of epipharynx situated lateral to labral rods. Mala with three ventral and eight dorsal setae, the dorsal setae branched. Dorsal surface of mala without discernible asperities among the setae. Alar area with one short seta. Seta on epipleurum of metathorax elongate, subequal to that on epipleurum of mesothorax. Spiracles on middle abdominal segments only slightly smaller than on segments I and VI.

Larva moderately large, robust, thicker through abdominal segments III to V. Head reddish brown, with broad, vaguely defined, non-pigmented stripes dorsally, free, as broad as long. Labral setae simple. Labral rods convergent in anterior half, subparallel posteriorly. All epipharyngeal setae simple. Ligula broadly rounded, without asperities.

Air tubes of thoracic spiracle less than one-half as long as peritreme. Spiracular area of mesothorax with two very short setae.

Typical abdominal segments with three dorsal folds, fold I developed laterally, and four postdorsal setae. Setae on spiracular area very short. Pleurum subdivided into three lobes. Asperities scarcely discernible.

Width of head: 3 mm. to 3.8 mm.

D. pandanae Zimmerman. Vanua Mbalavu, Lau Province, Fiji, August 8, 1938, from *Pandanus* trunk, E. C. Zimmerman.

D. lyriger Mshll. Afiamalu, Upolu, Samoa, 2200 ft., June 27, 1940, *Freycinetia*, O. H. Swezey.

VIII. Genus **Phacecorynes** Schoenherr, 1845

Posterior margin of abdominal segment IX with a pair of elongate, cylindrical projections, each projection with two elongate setae near the tip. Labrum with one basal sensillum. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx apparently situated in the same vertical plane as the labral rods, not clearly between the rods. Mala slender, with four ventral and eight dorsal setae, all the setae simple. Alar area with two setae, one short, the other minute. Seta on epipleurum and pleurum of mesothorax and metathorax moderately long, subequal. Spiracles on typical abdominal

segments readily discernible, the length of the air tubes subequal to that of subtriangular peritreme. Typical abdominal segments with four postdorsal setae.

Larva moderately small, thicker through abdominal segments III to V. Head reddish orange, with narrow, nonpigmented stripes dorsally, free, as broad as long, broadly rounded posteriorly. Endocarina vague, approximately one-fifth as long as frons. Labral setae simple. Labral rods subparallel, connected posteriorly by a transverse bridge. All epipharyngeal setae simple. Ligula rounded, moderately produced, without asperities. Asperities on dorsal surface of mala short, sparse.

Air tubes of thoracic spiracle more than one-half as long as peritreme. Spiracular area of mesothorax with two setae, one very short, the other minute.

Typical abdominal segments with four dorsal folds, fold I complete dorsally although short. One seta on spiracular area minute, the other very short. Pleurum subdivided into three lobes. Asperities inconspicuous, generally distributed over whole body except on sclerotized areas.

Width of head: 1.5 mm.

P. zamiae (Gyll.). Port Elizabeth, Africa, May 21, 1936, in *Encephalartos coffra*.

IX. Genus **Scyphophorus** Schoenherr, 1838

(Figs. 4, 16)

Posterior margin of abdominal segment IX with a pair of elongate, cylindrical projections, each projection with three elongate setae near apex. Labrum with a pair of basal sensilla. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx situated just lateral to labral rods. Mala broad, with four ventral and eight dorsal setae, one of the ventral and all of the dorsal setae branched. Alar area with one short seta. Seta on epipleurum of metathorax long, subequal to that on epipleurum of mesothorax. Spiracles on typical abdominal segments readily discernible, the air tubes usually slightly longer than peritreme.

Larva moderately large, robust, strongly thickened through abdominal segments IV and V. Head dark brown, with convergent, nonpigmented stripes dorsally, free, slightly longer than broad, oval posteriorly. Endocarina absent. Labral setae simple. Labral rods slightly convergent posteriorly, connected by a transverse bridge. One pair of anteromedian setae on epipharynx branched, the remaining epipharyngeal setae simple. Ligula rounded, without asperities. Asperities present on dorsal surface of mala.

Air tubes of thoracic spiracle shorter than triangular peritreme. Spiracular area of mesothorax with two setae, one very short, the other minute.

Typical abdominal segments with three dorsal folds, fold I developed laterally. One seta on spiracular area very short, the other short. Pleurum subdivided into four lobes. Asperities inconspicuous.

Width of head: 3.5 mm. to 4.5 mm.

S.acupunctatus Gyll. Several lots of larvae have been studied, mostly from Arizona and a few localities in Mexico. Host plants included *Agave*, *Dasylirion* and mescal (*Lophophora*).

S. yuccae Horn. Los Angeles County, Calif., October 5, 1886, stems of *Yucca whipplei*, Koebele.

X. Genus **Trochorhopalus** Kirsch, 1877

Posterior margin of abdominal segment IX broadly emarginate or with posterolateral angles broadly produced. Labrum with one basal sensillum. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx apparently situated in the same vertical plane as the labral rods, not clearly between the rods. Mala with four ventral and eight dorsal setae, one ventral and all dorsal setae branched. Alar area with two setae, one short to very short, the other minute. Spiracles on abdominal segments II to V not more than one-half as long as on segments I and VI. Typical abdominal segments with four postdorsal setae.

Larva moderately small, moderately robust, thicker through abdominal segments III to V. Head dark reddish brown, with short, inconspicuous less heavily pigmented stripes dorsally, free, longer than broad, rounded posteriorly. Endocarina absent. Labral setae simple. Labral rods subparallel, connected posteriorly by a stout transverse bridge. One pair of anteromedian setae on epipharynx branched, the remaining setae simple. Ligula short, rounded, without asperities. Asperities present along the dorsal row of setae on mala.

Spiracular area of mesothorax with two setae, one very short, the other minute. Seta on epipleurum of metathorax moderately long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with three dorsal folds, fold I developed laterally. Setae on spiracular area very short, subequal. Pleurum subdivided into four lobes. Asperities inconspicuous, generally distributed dorsally on mesothorax, metathorax and abdominal segments I to V and ventrally on segments II to V.

Width of head: 1.75 mm.

T. strangulatus (Gyll.). Victorias, Occ. Negros, P. I., 1929, in sugar cane, W. D. Pierce.

XI. Genus **Cactophagus** Leconte, 1876

Asperities conspicuous, stout, hooked, arranged in transverse, nearly regular rows dorsally on metathorax and abdominal segments I to VII and present laterally or ventrally and laterally on the abdominal segments, the arrangement more confused laterally and ventrally. Labrum with one basal sensillum. All epipharyngeal setae simple. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx apparently absent, replaced by small clusters of asperities lateral to the rods. Mala with five ventral and seven dorsal setae, all setae simple. Alar area with two setae, one short the other minute. Spiracles on abdominal segments I to VII subequal. Posterior margin of abdominal segment IX without protuberances.

Larva large, robust, thicker through abdominal segments V and VI. Head brown, often with broad, vague, less heavily pigmented dorsal stripes, free, as broad as long, broadly oval posteriorly. Endocarina present, approximately one-third as long as frons. Labral setae simple.

Labral rods slightly convergent, connected posteriorly by a transverse bridge. Ligula projecting, rounded apically, without asperities. Asperities on dorsal surface of mala moderately long.

Spiracular area of mesothorax with three setae, one moderately long, one short, one very short. Seta on epipleurum of metathorax moderately long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with three dorsal folds, fold I developed laterally, and four postdorsal setae. Spiracular area with one seta very short to minute, the other moderately long. Pleurum subdivided into four lobes.

Width of head: 3 mm. to 5 mm.

C. spinolae subspecies *validus* (Lec.). Garden Grove, Calif., A. C. Davis. Tucson, Ariz., in *Cereus giganteus*, Hubbard and Schwarz, Hubbard No. 752.

Cactophagus sp. Mexico, March 25, 1946, in *Ferocactus*, V. O. Miller.

XII. Genus **Rhodobaenus** Leconte, 1876

(Fig. 15)

Labrum with one basal sensillum. All epipharyngeal setae simple. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx present lateral to labral rods. Mala with five ventral and usually eight dorsal setae, all setae simple. Length of air tubes of thoracic spiracle subequal to that of subtriangular peritreme. Alar area with two setae, one minute the other very minute. Spiracles on abdominal segments I to VII subequal. Asperities inconspicuous, generally distributed dorsally on abdominal segments I to V and ventrally on segments IV to VI. Posterior margin of abdominal segment IX with a pair of short, often inconspicuous, subconical projections, the projections not bearing setae.

Larva moderately large, moderately slender, slightly but distinctly thicker through abdominal segments IV to VI. Head orange, free, slightly longer than broad, broadly rounded posteriorly. Endocarina approximately one-half as long as frons. Labral setae simple. Labral rods convergent posteriorly, usually not connected by a transverse bridge. Ligula projecting slightly, without asperities. Asperities present on dorsal surface of mala near the row of setae.

Spiracular area of mesothorax with three very short to minute setae. Seta on epipleurum of metathorax moderately long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with four dorsal folds, fold I complete although short, and four postdorsal setae. Spiracular area with one seta very short, the other short. Pleurum subdivided into three lobes.

Width of head: 2.8 mm.

R. tredecimpunctata (Ill.). A common, widespread species the larvae of which are found in stems of numerous plants, largely composites.

XIII. Genus **Calendra** Clairville, 1798

(Figs. 7, 17)

Labrum with a pair of basal sensilla. One or two pairs of anteromedian setae on epipharynx branched, the remaining setae simple. Asperities present and distinct laterally on epipharynx. Accessory

sensory pores of epipharynx present, located lateral to labral rods. Mala with five ventral and eight dorsal setae, one ventral and at least six dorsal setae branched. Air tubes of thoracic spiracle one-half as long as or subequal in length to subtriangular peritreme. Alar area with two setae, one usually distinctly shorter than the other, the shorter seta occasionally scarcely discernible. Spiracles on abdominal segments I to VII subequal. Asperities usually more abundant on abdominal segments IV to VI, inconspicuous to moderately conspicuous, the asperities on anterior half of prodorsum of abdominal segment I not obviously stouter than those on the neighboring areas of the body. Posterior margin of abdominal segment IX without projections.

Larva small to moderately large, moderately robust, thicker through abdominal segments IV to VI. Head reddish brown to brown, with vaguely defined, nonpigmented stripes dorsally, free, approximately as broad as long, oval to broadly oval posteriorly. Endocarina usually less than one-half as long as frons. Labral seta 2 branched or simple. Labral rods connected posteriorly by a transverse bridge. Ligula slightly produced, nearly always with asperities laterally or apically. Asperities present on dorsal surface of mala.

Spiracular area of mesothorax with three setae, one usually distinctly longer than the remainder. Seta on epipleurum of metathorax long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with three dorsal folds, fold I developed laterally, and four postdorsal setae. Spiracular area with one seta distinctly longer than the other. Pleurum usually subdivided into four lobes. Eusternal setae on abdominal segment VIII usually short to very short and scarcely discernible.

Width of head: 1.7 mm. to 3 mm.

C. ludoviciana (Chttn.). Alvin, Tex., October 21, 1944, in stem of rice. Rosenberg, Tex., October 16, 1944, in stem of rice.

C. maidis (Chttn.). Columbia, S. C., August 30, 1881, in corn stalk, L. O. Howard. Meredith, Lee County, S. C., 1928, O. L. Cartwright.

C. cariosa (Oliv.). Grant, Fla., July 25, 1901, at roots of nut grass, R. T. Smith. Pierce, Tex., December 3, 1907, *Cyperus exaltatus*, J. D. Mitchell. Pompano, Fla., March 3, 1945, bases of old grass stems.

C. parvula (Gyll.). Washington, D. C., July 17, 1899, (*Agrostis stolonifera*) = *A. alba*.

Calendra sp., near *parvula* (Gyll.). Miles City, Mont., August 1938, injuring lawns, E. J. Woolfolk.

C. minima (Hart.). East Avon, N. Y., July 3, 1930, in wheat stems, C. C. Hill. Monmouth County, N. J., June 19, 1943, in wheat stem.

C. tarda (Fall). near Whittier, Calif., June 8, 1940, from lawn, H. D. Nelson.

C. zeae (Walsh). Morgantown, W. Va., September 11, 1899, on timothy, A. D. Hopkins.

C. callosa (Oliv.). Stillwater, Okla., July 31, 1895, chufa, A. N. Caudell. Silver City, N. M., August 8, 1899, corn, J. K. Metcalf. Arlington, Va., May 1, 1906. El Paso, Tex., several dates, in stalk or crown of corn.

C. pontederiae (Chttn.). Stoughton, Mass., August, 1924, in rootstalks, *Pontederia cordata*, D. H. Blake.

C. venata (Say). Beaumont, Tex., October 19, 1943, in rice stalk. Eagle Lake, Tex., November 16, 1943, in top roots of rice.

Calendra sp., probably *venata* (Say). Bay St. Louis, Miss., May 11, 1945, in roots of *Spartina*, G. Rau.

C. phoeniciensis (Chttn.). Alhambra, Calif., October 12, 1942, Bermuda grass, R. H. Smith. Los Angeles, Calif., June 17, 1944, in lawn, R. H. Smith.

XIV. Genus **Metamasius** Horn, 1873

(Figs. 8, 13)

Labrum with one basal sensillum. One, two or three pairs of the anteromedian setae on epipharynx branched. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx present, located lateral to labral rods. Ligula projecting, with asperities laterally and apically. Mala with four ventral and eight dorsal setae, one or more than one ventral and all dorsal setae branched. Air tubes of thoracic spiracle approximately one-half as long as elliptical peritreme. Alar area with two setae, one short to moderately long, the other minute. Spiracles on abdominal segments I to VII subequal. Asperities usually moderately distinct, those on anterior half of prodorsum of abdominal segment I obviously stouter than those on the neighboring areas of the body. Posterior margin of abdominal segment IX transverse to smoothly rounded.

Larva often large, robust, thicker through abdominal segments V and VI. Head orange or brown, usually with paler stripes dorsally, free, as broad as long, broadly oval posteriorly. Endocarina one-third to one-fourth as long as frons. Labral seta 2 occasionally branched. Labral rods usually connected posteriorly by a transverse bridge. Asperities abundant on dorsal surface of mala.

Spiracular area of mesothorax with three setae, one moderately long, the other two very short. Seta on epipleurum of metathorax long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with three dorsal folds, fold I developed laterally, and four postdorsal setae. Spiracular area with one seta distinctly longer than the other. Pleurum subdivided into three lobes. Eusternal setae on abdominal segment VIII usually moderately long, readily discernible.

Width of head: 3.2 mm. to 4.5 mm.

M. ritchiei Mshll. Six miles back of Kingston, Jamaica, September 16, 1917, pineapple, A. H. Ritchie.

M. hebetatus (Gyll.). Hamburg Farm, Reventazón, Ebene Limon, Costa Rica, November 3, 1933, in leaf sheath of *Iriartea*, F. Nevermann. (rec'd through F. van Emden.)

Metamasius sp., probably *anceps* (Gyll.). Region of Santa Cruz, Bolivia, received January 7, 1941, ex sugar cane. (rec'd from Bolivian Legation.)

M. sericeus (Oliv.). Cuba, January 6, 1928, in banana stalk. Canal Zone, February 28, 1928, in sugar cane.

M. sericeus var. *carbonarius* (Chevr.). Plantation Oaxaqueña, Santa Lucrecia, Vera Cruz, Mexico, September, 1911, in fermenting cane, Urich.

M. hemipterus (L.). La Merced, Peru, June, 1927, sugarcane stalks, C. H. T. Townsend. Puerto Rico, 1917, in royal palm.

XV. Genus **Rhabdoscelus** Marshall, 1943

(Fig. 12)

Labrum with one basal sensillum. At least one pair of anteromedian setae on epipharynx branched. Asperities present and distinct laterally on epipharynx. Accessory sensory pores of epipharynx present, located lateral to labral rods. Ligula rounded, without asperities. Mala broad, with three ventral and eight dorsal setae, all dorsal setae branched. Air tubes of thoracic spiracle approximately one-half as long as oval peritreme. Alar area with two setae, one short to moderately long, the other minute. Spiracles on abdominal segments I to VII subequal. Asperities moderately distinct, those on anterior half of prodorsum of abdominal segment I stouter than those on neighboring areas of body. Posterior margin of abdominal segment IX with a distinct, smoothly excavated emargination.

Larva moderately large, moderately robust, thicker through abdominal segments IV to VI. Head reddish brown, scarcely lighter dorsally, free, slightly longer than broad, broadly oval posteriorly. Endocarina approximately one-third as long as frons. Labral setae simple. Labral rods connected posteriorly by a transverse bridge. Asperities present on dorsal surface of mala.

Spiracular area of mesothorax with three setae, one long, the other two short to very short. Seta on epipleurum of metathorax long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with three dorsal folds, fold I developed laterally, and four postdorsal setae. Spiracular area with one seta long, the other minute. Pleurum subdivided into three lobes. Eusternal setae on abdominal segment VIII moderately long, readily discernible.

Width of head: 2.8 mm. to 3.2 mm.

R. obscurus (Boisd.). Widely distributed on the islands of the Pacific Ocean where it attacks banana, cocoanut palm and sugar cane.

XVI. Genus **Myocalandra** Faust, 1895

Head partially retracted into prothorax. Labrum with one basal sensillum. All setae on epipharynx simple. Asperities not discernible laterally on epipharynx. Accessory peglike sensilla of epipharynx present, clearly located between the rods. Setae on ligula simple. Mala with five ventral and seven dorsal setae, the one or two posterior dorsal setae branched, the remaining setae simple. Dorsal surface of mala without discernible asperities. Pronotum with transverse band of fine asperities along posterior border. Alar area with two very short, subequal setae. Typical abdominal segments with three postdorsal setae.

Larva small, moderately slender, slightly thicker through abdominal segments IV to VI. Head with anterior border light brownish yellow, distinctly longer than broad, bluntly oval posteriorly. Endocarina absent. Labral setae simple. Labral rods convergent and united posteriorly. Ligula not produced, with asperities apically.

Spiracular area of mesothorax with three short setae, one blunt

and bent, the other two attenuate. Seta on epipleurum of metathorax short, subequal to that on epipleurum of mesothorax.

Abdominal spiracles small but complete, the air tubes subequal in length to triangular peritreme. Typical abdominal segments with three dorsal folds, fold I developed laterally. Setae on spiracular area short to very short, one blunt, the other attenuate. Pleurum subdivided into four lobes. Asperities inconspicuous, short, more evident on abdominal segments III and IV.

Width of head: 0.6 mm. to 0.65 mm.

M. elongata (Roelofs). Japan, July 15, 1939, in bamboo stem of child's umbrella, F. C. Piper.

XVII. Genus **Eucalandra** Faust, 1899

(Figs. 3, 11)

Head slightly retracted into prothorax. Labrum with one basal sensillum. Anterolateral and anteromedian setae on epipharynx branched. Asperities developed in a pair of longitudinal, narrow bands along the labral rods, not discernible laterally on epipharynx. Accessory sensory pores of epipharynx present, clearly located between the labral rods. Anterior pair of setae on ligula branched. Mala with five ventral and seven dorsal setae, the six anterior dorsal setae branched, the remaining setae simple. Dorsal surface of mala with elongate, slender asperities. Pronotum with median longitudinal band of fine asperities. Alar area with two short to very short setae. Typical abdominal segments with four postdorsal setae.

Larva moderately small and robust, of nearly equal thickness through thoracic and first four abdominal segments, abdominal segments V to IX sloping. Head orange to reddish orange, lighter dorsally in two longitudinal stripes, longer than broad, oval posteriorly. Internal epicranial ridge distinct. Endocarina absent. Labral seta 2 branched. Labral rods stout, convergent but usually not united posteriorly. Ligula rounded, with asperities.

Spiracular area of mesothorax with three setae, two short, the third very short, cylindrical. Seta on epipleurum of metathorax moderately long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with three dorsal folds, fold I scarcely distinguishable laterally. Setae on spiracular area short, one cylindrical, the other attenuate. Epipleurum on anterior abdominal segments extending dorsal to a line connecting the spiracles, the setae comparatively widely separated. Pleurum subdivided into four lobes. Asperities inconspicuous, moderately abundant, generally distributed over whole body.

Width of head: 1.2 mm. to 1.3 mm.

E. setulosa (Gyll.). Several lots of larvae have been studied, from Mexico and northern South America. The most common host is bamboo although some specimens from Mexico were collected from stems of *Merostachys racimiflora*.

XVIII. Genus **Diocalandra** Faust, 1895

Head slightly retracted into prothorax. Labrum with one basal sensillum. All setae on epipharynx simple. Asperities not discernible

laterally on epipharynx. Accessory sensory pores of epipharynx present, clearly located between the labral rods. Setae on ligula simple. Mala with five ventral and eight dorsal setae, one ventral and all dorsal setae branched. Dorsal surface of mala with asperities present, short and sparse. Pronotum without median longitudinal band of asperities. Alar area with two short, subequal setae. Typical abdominal segments with four postdorsal setae.

Larva moderately small, moderately slender, only slightly thicker through abdominal segments IV to VI. Head orange to reddish orange, vaguely lighter dorsally, slightly longer than broad, broadly oval posteriorly. Endocarina present or absent. Labral setae simple. Labral rods slightly convergent posteriorly, connected by a transverse bridge. Ligula rounded, with asperities.

Spiracular area of mesothorax with three setae, one cylindrical, blunt, the other two longer, subequal, attenuate. Seta on epipleurum of metathorax moderately long, subequal to that on epipleurum of mesothorax.

Typical abdominal segments with four dorsal folds. Spiracular area with one seta very short, cylindrical, the other short to moderately long, attenuate. Pleurum subdivided into four lobes. Asperities inconspicuous, generally distributed over whole body.

Width of head: 1.1 mm. to 1.2 mm.

D. taitensis (Guer.). Hawaii, in petiole and husk of *Cocos nucifera*, several lots.

Tribe **Sitophilini**

This tribe is represented in the collection by larvae of *Sitophilus* only.

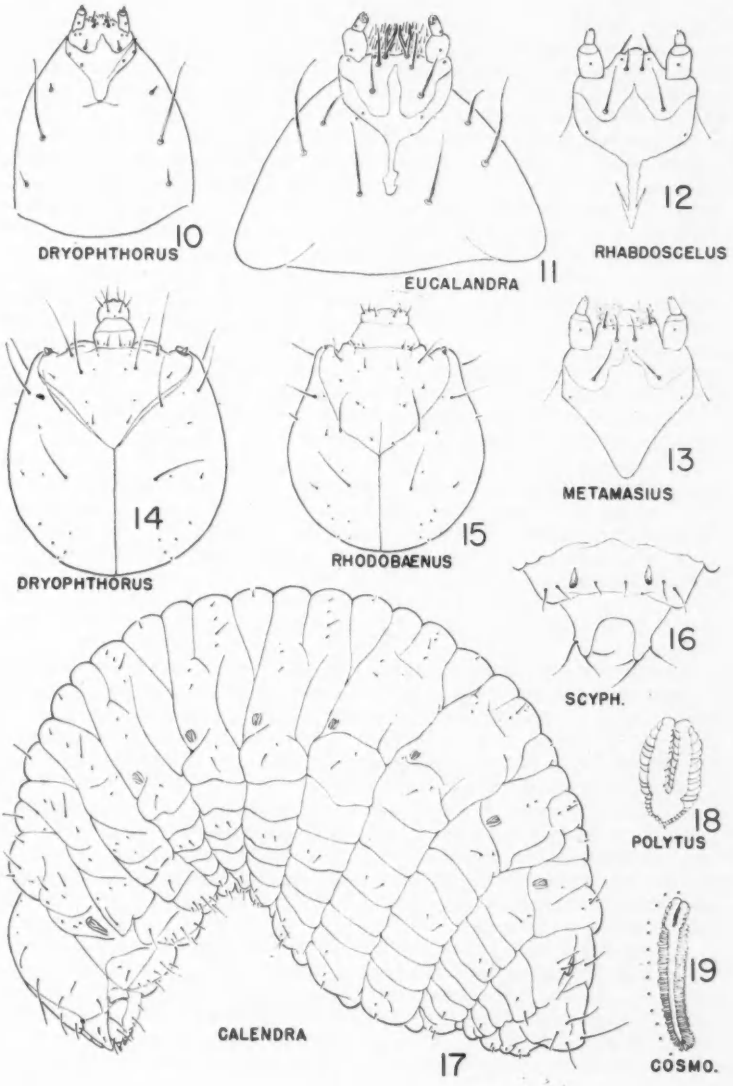
XIX. Genus **Sitophilus** Schoenherr, 1838

(Fig. 6)

Head partially retracted into prothorax, longer than broad, anterior border finely granulate. Labral setae short, subequal, simple. Labrum with one basal sensillum. Labral rods nearly straight, slightly convergent but not connected posteriorly. Epipharynx with two anterolateral setae. All setae on epipharynx simple. Sensory pores not discernible on epipharynx, replaced by minute, peglike sensilla. Mala with five ventral and four to six dorsal setae, all setae simple. Thoracic spiracle bicameral, the air tubes distinct. Typical abdominal segments with three postdorsal setae. Posterior margin of abdominal segment IX without projections, on each side with two setae, one moderately long, the other short to very short.

EXPLANATION OF PLATE II

Fig. 10. *Dryophthorus distinguendus* Perkins, labium, × 100. Fig. 11. *Eucalandra setulosa* (Gyll.), labium, × 75. Fig. 12. *Rhabdoscelus obscurus* (Boisd.), prementum, × 50. Fig. 13. *Metamasius ritchiei* Mshll., prementum, × 25. Fig. 14. *Dryophthorus distinguendus* Perkins, head, dorsal view, × 50. Fig. 15. *Rhodobaenus tredecimpunctata* (Ill.), head, dorsal view, × 15. Fig. 16. *Scyphophorus acupunctatus* Gyll., abdominal segments VIII and IX, dorsal view, × 30. Fig. 17. *Calendra maidis* (Chttn.), lateral view of larva, × 8. Fig. 18. *Polytus mellerborgi* (Boh.), left thoracic spiracle, × 165. Fig. 19. *Cosmopolites sordidus* (Germ.), left thoracic spiracle, × 75.


10
DRYOPHTHORUS
EUCALANDRA
11
12
RHABDOSCELUS
14
DRYOPHTHORUS
15
RHODOBAENUS
13
METAMASIUS
16
SCYPH.
18
POLYTUS
CALENDRA
17
19
COSMO.

Larva small, robust, subglobular. Body without pigmented areas. Head lightly pigmented, with posteriorly convergent, often vaguely defined dorsal, nonpigmented stripes. Endocarina present. Setae on frons moderately long, subequal. Ocellus moderately distinct. Accessory sensory appendage of antenna conical. Epipharynx without asperities. Ligula smoothly rounded, without asperities. Dorsal surface of mala without asperities.

Spiracular area of mesothorax with four setae. Postdorsum of mesothorax and metathorax with three very short setae. Alar area with one very short seta. Seta on pleurum and epipleurum of mesothorax and metathorax short.

Typical abdominal segments with three dorsal folds, fold I not distinguishable laterally. Typical abdominal segments with postdorsal setae very short, subequal. Setae on spiracular area very short, subequal, one seta blunt. Pleurum subdivided into three indistinct lobes, the middle lobe with or without one very short seta. Sternellum not distinguishable. Anus terminal. Asperities fine, usually blunt, generally distributed over body.

Width of head: 0.55 mm. to 0.85 mm.

S. granarius (L.), the granary weevil. Several lots of larvae, mostly from Greece and Turkey, attacking acorns and valonea nuts.

S. linearis (Hbst.). A common species frequently intercepted in tamarind seeds from Mexico, Central America and the West Indies.

S. oryza (L.), the rice weevil. Larvae examined from barley, chestnuts and acorns; also known to attack rice, wheat, corn, rye, etc.

S. rugicollis (Csy.). Malhan Range, Dehra Dun, United Provinces, India, ex seeds *Shorea robusta*, "R. O."

Subfamily **Stromboscerinae**

Frons with four pairs of setae. Epipharynx with three anterolateral and six anteromedian setae and four median spines, all simple. Posterior pair of setae on postmentum separated by a distance subequal to that between the setae of middle pair. Postdorsum of mesothorax and metathorax with two minute setae. Spiracles on abdominal segments II to VI scarcely discernible, each reduced to a minute sclerotic spot. Three minute setae on postdorsum of typical abdominal segments. Pleurum of typical abdominal segments incompletely subdivided into two triangular lobes. Abdominal segment VIII with one short fleshy process on each lateral margin. Abdominal segment IX terminal, its posterior margin with a pair of fleshy processes.[4] Anus ventral, subterminal.

Larva small, slender to moderately robust, slightly or not at all thickened through middle abdominal segments, with abdominal segments VIII and IX flattened to slightly concave dorsally. Head free. Internal epicranial ridge absent. Endocarina absent. Dorsal epicranial seta 2 minute, 1, 3 and 5 long. Lateral epicranial seta 1 minute, 2 long. Ocellus not distinguishable. (Gardner states that the ocellus in *Dryopthoroides* and (*Xerodermus*) = *Orthosinus* is present but small).

[4]If, as seems possible, *Anius* later proves to belong in the Stromboscerinae it will be necessary to alter this and a few other statements.

Clypeus with two setae and sensillum on each side, near base. Labrum with one basal sensillum. Epipharynx with one pair of minute conical sensilla in front of anterior pair of median spines, and with two clusters of sensilla, two or three in each cluster, located more posteriorly. Epipharynx with numerous, fine to distinct asperities between the labral rods. Mandible with two apical teeth. Two setae present on outer surface of mandible. Ligula with four setae. Premental sclerite complete, indistinctly pigmented, with short anterior and posterior median extensions. Mala with five ventral and seven dorsal setae.

Pronotum with ten setae, one moderately long to long, the remainder usually minute. Thoracic spiracle bicameral, the air tubes well developed, annulated. Spiracular area of mesothorax with one minute, blunt seta. Alar area with one minute seta. Epipleurum of mesothorax with one long seta, epipleurum of metathorax and pleurum of mesothorax and metathorax with one minute seta. Pedal area with four setae, one long, the others minute. Sternum with one pair of minute setae.

Typical abdominal segments with three dorsal folds. Prodorsal seta present on typical abdominal segments. Pedal area with one minute seta. Eusternum with two minute setae. Sternellum present. Individual asperities, when discernible, complex, with several minute points.

The Stromboscerinae, in the sense used here, includes *Dryophthorus*, *Stenommatus*, *Dryophthoroides* and *Orthosinus*, although larvae of only *Dryophthorus* and *Stenommatus* are available for study. Heretofore *Dryophthorus* and *Stenommatus* have been included in the Cossoninae on the basis of characters of the adults. A study of the characters of the larvae, however, shows that these two genera should not be placed in the Cossoninae. From the subfamily characters recorded above, larvae of typical Cossoninae differ as follows; epipharynx without asperities, or these indistinct; none of the setae on mala branched; spiracles well developed on middle abdominal segments; orifice of spiracles oval to subcircular; posterior end of body without fleshy processes; anus terminal, often subdorsal.

It should be pointed out that larvae of *Dryophthorus* and *Stenommatus* differ from those of *Dryophthoroides* and *Orthosinus* in two important characteristics. Gardner states that in *Dryophthoroides* and *Orthosinus* labial palpus has two articles and pleurum of each typical abdominal segment is subdivided into three lobes. In larvae of *Dryophthorus* and *Stenommatus* labial palpus has clearly only one article and pleurum on each typical abdominal segment is obscurely subdivided into two subtriangular lobes. In other characteristics, however, the four genera are remarkably similar. Perhaps the most significant characters which they hold in common are the reduction in size of spiracles on at least the middle abdominal segments, and the presence of fleshy processes at posterior end of body. It is unfortunate that Gardner did not remark upon the number of setae on frons. This number is often constant for all members of a tribe or subfamily among the Curculionidae.

One further fact should be noted. Larvae of *Dryophthorus* approach some of the Cossoninae in one peculiarity. The granular area on the

inner surface of the mandible resembles the condition found in *Caulophilus*, *Cossonus* and others. The similarities among the four genera here placed in the Stromboscerinae appear to be of more significance than those between *Dryophthorus* and *Stenommatus* and typical Cossoninae. For these reasons I believe that *Dryophthorus* and its relatives should be considered as forming a distinct group, separate from the Cossoninae and rather approaching the Calendrinae.

I have used the subfamily name Stromboscerinae for this group with some hesitation and mostly because it is an available name for the group which includes *Dryophthoroides* and *Orthosinus*. As far as can be ascertained the biology of *Stromboscerus* is not recorded and the characters of its larvae are unknown, and it is quite possible that the larvae will not have characters which indicate a close relationship with the larvae which are considered here.

KEY TO GENERA OF STROMBOSCERINAE

Frontal setae 4 and 5 long, subequal (fig. 14); inner surface of mandible with a granular area; abdomen with one pair of functional spiracles, on segment VIII. . . . . I. **Dryophthorus** (p. 436)

Frontal seta 4 minute, 5 long; inner surface of mandible without granular area; abdomen with two pairs of functional spiracles, on segments I and VIII, II. **Stenommatus** (p. 437)

I. Genus **Dryophthorus** Germar, 1824

(Figs. 9, 14)

Frons, near middle, with a pair of short, blunt, sclerotized tubercles (except *D. americanus*) and, near anterior margin behind catapophysis, with a low, narrow, transverse ridge (less distinct in *D. americanus*). Frontal setae 4 and 5 long, subequal. Inner surface of mandible with a comparatively large, subapical, slightly concave granular area, the granules in regular rows. Dorsal condyle of mandible projecting, with a distinct rim. Labial palpus with one article. Abdomen with one pair of functional spiracles, on segment VIII.

Head orange to dark orange, vaguely lighter dorsally or with paired, subparallel, nonpigmented stripes dorsally. Accessory sensory appendage of antenna subconical to egg-shaped. Clypeus narrow, rigid, seta 1 short, usually longer than 2. Median sensillum of labrum basal. Posterior clusters of sensilla on epipharynx located behind the posterior pair of median spines. Each branched seta on dorsal surface of mala with three to six branches.

Peritreme of thoracic spiracle subtriangular. Orifice of spiracle an elongate slit with smooth margins.

Abdominal segment VIII with a short, fleshy process on each lateral margin. Abdominal segment IX projecting posteriorly in two, well separated fingerlike processes.

Width of head: 0.5 mm. to 1.2 mm.

D. insignis Sharp. Kahaua, Oahu, T.H., January 19, 1930, from *Pipturus*, O. H. Swezey.

D. declivis Sharp. Kaimuahoua, Oahu, T. H., February 1928, from rotten wood, O. H. Swezey.

D. distinguendus Perkins. Honolulu, T. H., December 27, 1928, from telephone pole, O. H. Swezey.

D. modestus Sharp. Pupukea, Oahu, T. H., 1200 ft., October 30,

1927, from rotten log *Acacia koa*, O. H. Swezey. Kaimuahoua, Oahu, T. H., February 25, 1928, from rotten Bobea wood, O. H. Swezey.

D. americanus Bedel. near Plummers Island, Md., July 25, 1913, in rotting pine with *Micromalthus*, Schwarz and Barber. New York, N. Y., November 1937, in decaying wood from a cable manhole. Vienna, Va., March 19, 1942, from old rotten chestnut, J. C. Bridwell.

II. Genus **Stenommatus** Wollaston, 1873

Frons without tubercles and without ridge behind catapophysis. Frontal seta 4 minute, 5 long. Inner surface of mandible without granular area. Dorsal condyle of mandible not projecting and without a sharp rim. Labial palpus with one article. Abdomen with two pairs of functional spiracles, on segments I and VIII.

Head uniformly orange, slightly longer than broad, broadly oval posteriorly. Accessory sensory appendage of antenna egg-shaped to rounded apically. Clypeus broader than in *Dryophthorus*, not rigid, the clypeal setae minute. Median sensillum of labrum located approximately two-thirds the distance from base of labrum to apex. Posterior clusters of sensilla on epipharynx located between the anterior and posterior pairs of median spines. Each dorsal seta on mala with two branches.

Peritreme of thoracic spiracle broadly oval. Orifice of spiracle indistinct, apparently an irregular slit.

Abdominal segment VIII with one low process on each lateral margin. Abdominal segment IX projecting posteriorly in two short, broad, flattened, indistinctly separated, apically notched processes.

Width of head: 0.3 mm.

S. museae (Mshll.). Honolulu, T. H., March 27, 1935, from banana corm, O. H. Swezey.

BIBLIOGRAPHY

Anderson, W. H. 1947. A terminology for the anatomical characters useful in the taxonomy of weevil larvae. Proc. Ent. Soc. Wash., 49: 123–132, illus.

Bondar, Gregorio. 1940. Insetos nocivos e molestias do coqueiro (*Cocos nucifera*) no Brasil. Bol. Inst. Cent. Fom. Econ., Bahia, 8: 1–160, illus.

Böving, Adam G., and **Craighead, F. C.** 1931. An illustrated synopsis of the principal larval forms of the order Coleoptera. Ent. Amer. (n. s.) 11: 1–351, illus.

Cotton, Richard T. 1920. Rice weevil, (*Calandra*) *Sitophilus oryza*. Jour. Agr. Res. 20: 409–422, illus.

1920. Tamarind pod-borer, *Sitophilus linearis* (Herbst). Jour. Agr. Res. 20: 439–446, illus.

1921. Four Rhynchophora attacking corn in storage. Jour. Agr. Res. 20: 605–614, illus.

1924. A contribution toward the classification of the weevil larvae of the subfamily Calendrinae occurring in North America. Proc. U. S. Natl. Mus. 66 (art. 5): 1–11, illus.

Gardner, J. C. M. 1934. Immature stages of Indian Coleoptera (14) (Curculionidae). Indian Forest Rec. Ent. Ser. 20 (2): 1–48, illus.

1938. Immature stages of Indian Coleoptera (24, Curculionidae, contd.). Indian Forest Rec. New Ser. Ent. 3: 227–261, illus.

Marshall, Guy. 1932. Notes on the Hylobiinae. Ann. and Mag. Nat. Hist. (10) 9: 341–355.

Moznette, G. F. 1920. Banana Root Borer. Jour. Agr. Res. 19: 39–46, illus.

Zimmerman, Elwood C. 1939. A new Fijian *Diathetes* injurious to *Pandanus* (Coleoptera: Curculionidae). Proc. Hawaiian Ent. Soc. 10: 335–338, illus.

MOUND CHANGES AFTER TEN YEARS IN COLONIES OF FORMICA EXSECTOIDES FOREL

ELIZABETH E. HAVILAND
University of Maryland,
College Park, Maryland

In May 1936[1] a population survey of the mounds of *Formica exsectoides* was made in a ten acre plot near Beltsville, Maryland. The position of each mound was plotted on a chart and the height measured. Ten years later this chart was used in making a resurvey. The area then showed few changes in plant development other than normal growth. A few Virginia pines had been cut along one side adjoining an area that had been cleared and cultivated sporadically before 1936.

In 1946 there were 86 mounds, an increase of 13. Of the 73 mounds present in 1936, 54 were found. Eight of these had been abandoned, 17 were lower than ten years before, five were the same heighth, and 24 were higher. Of those lower than before, three had been damaged by animals and five had moss growing over part of the cone, an indication of senility. Sixty-six per cent of the colonies had maintained themselves in the same mound for the ten years; only half of them had increased the mound height.

The heights of the mounds ranged from 3 to 27 inches, with 14 and 15 inches the most frequent. In 1936, 13 inches was the most frequent height. The 24 mounds that were higher at the second measuring had a range of increase from one to 14 inches. The average increase was 6.4 inches.

In 1946, 19 mounds were 20 inches or more in height, of which 17 were present ten years ago. Nineteen mounds ten inches or less in height were found, of which 15 were not present in 1936.

The 37 mounds located for the first time in 1946, ranged in height from 3 to 22 inches, with four mounds 11 inches and four 15 inches high. One of these known to have been built by a migrating colony, attained a height of 12 inches in one summer.

Conditions that encourage growth, both in numbers of mounds and in increased height, were studied with respect to distance from trees, height of trees, presence of undergrowth and relative amount of sunlight. New mounds were found scattered over the entire area, with three locations having slightly higher percentages of increase. Two of these locations were on the edge of the cleared area where the light intensity was greatest. The third was within the woods where the light was reduced because of numbers and height of trees.

Another location, noticeable because only five mounds were active where 13 had been in 1936, had trees, oaks mostly, that had grown considerably so that the sunlight had been reduced by several hours a day.

The various factors considered seem to have some bearing on the increase in the number of mounds but no clear correlation could be found between the increase and any of the factors studied. No studies were made of the nest population nor of the abundance of food.

[1]Cory, Ernest N., and Elizabeth E. Haviland, 1938, Ann. Ent. Soc. Amer., 31: 50–57.

THE WINGS OF BRACONIDAE

(Hymenoptera)[1]

GARLAND T. RIEGEL[2]
University of Illinois

Various systems of naming have been used for the veins and cells of hymenopterous wings. These fall into two groups; those evolved for use in taxonomy as convenient descriptive terms, and those used to indicate structural homologies.

Rohwer and Gahan (1916) attempted to bring together all the systems and to establish one set of terms for use in all Hymenoptera. This is still a very useful paper, especially when one is trying to interpret the keys and descriptions of past workers. These authors rejected the Comstock-Needham system because they felt that it was not stable enough at that time to warrant adoption by taxonomists in the Hymenoptera. They added, "We believe it is much better for taxonomic work to designate a given area by a given name and call it that regardless of its possible homologies or analogies. As a system of designating veins and cells for the morphologist the Comstock-Needham system possesses certain advantages, but as a terminology to be used in taxonomic work we do not believe it is desirable." And indeed there seems to have been some justification for this statement at that time. In discussing the above quotation Ferris, in his book on the principles of systematic entomology (1928) said, "Why this artificial division between systematics and morphology should have arisen is difficult to see....However...the division clearly exists, as is unmistakably indicated by the statement just quoted. It exists to the great detriment of our systematic work."

Prior to Rohwer and Gahan's paper, others had tried to standardize the terminology of hymenopterous wings. Shuckard (1836), Haliday (1838), André (1879), and Morley (1909) are examples. The latter author gives a good historical review of the subject.

As recently as 1927 the late D. S. Wilkinson, by means of tables and very clear diagrams, proposed a set of descriptive terms for use in the Braconidae. And many of his terms differed from those selected by Rohwer and Gahan. So it would seem that changes in terminology are not limited to the morphologists, but will continue to be proposed by taxonomists.

Advances in the so called Comstock-Needham system have been great since 1916, and I feel that this system now can be used throughout

[1]Contribution No. 283 of the Department of Entomology, University of Illinois. Published by permission of the Graduate College. Much of this material was included in a Master's thesis submitted in February, 1940, and has been expanded while the author was holding a Post-doctorate Fellowship from the Graduate College. The writer wishes to thank Professors W. P. Hayes, W. V. Balduf, and especially, H. H. Ross, for many helpful suggestions.

[2]Present address: Zoology Department, Eastern Illinois State College, Charleston, Illinois.

the order with little confusion. The advantages of this flexible system over inflexible descriptive terms are obvious. With it the taxonomist can appreciate homologies with groups of insects other than his own, and characters furnished by the wings are applied more easily to problems of phylogeny. Further, inasmuch as the Comstock-Needham system is taught almost exculsively in the schools, it is a distinct task for the student to learn and apply the older system.

In his admirable paper on the wing venation of the Hymenoptera, Ross (1936) has advanced a modification of the Comstock system that seems to put the application of that system in the Hymenoptera on stable ground. His interpretation of the hymenopterous wing is logical, easily understood, and holds up well for the entire order. It is followed in this paper. Ross (*op. cit.*), and Duncan (1939), have reviewed the pertinent morphological literature. Burks (1938) has shown how Ross' modification applies to the Chalcidoidea, Duncan (1939) has used it for the Vespinae, and Michener (1944) has applied it to the bees.

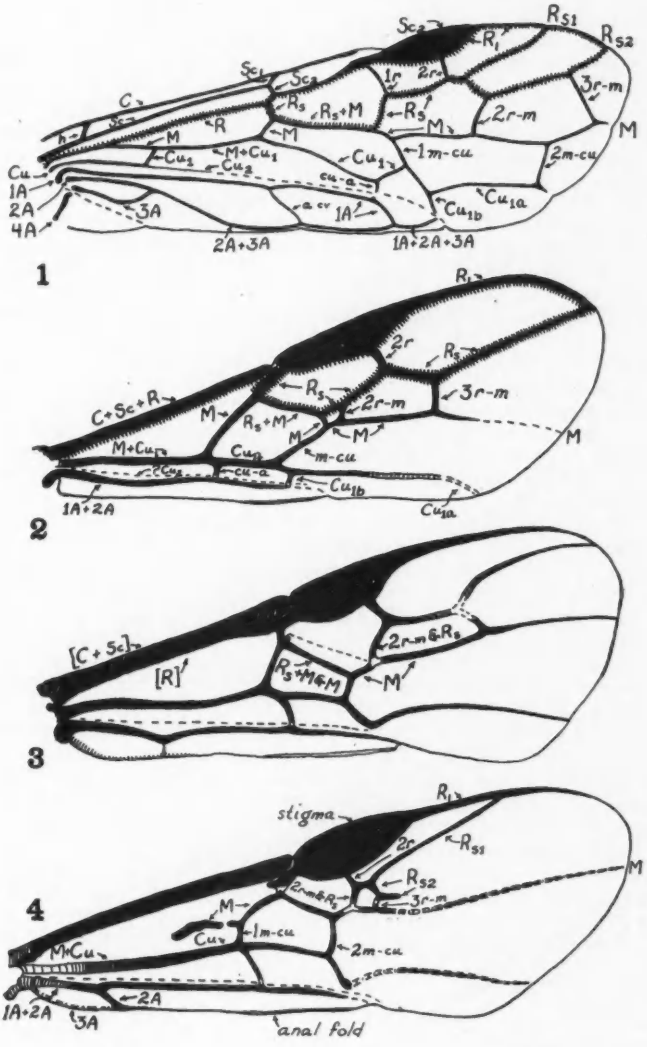
While the Comstock system has been applied to other families in the order, to the best of my knowledge it has never been used in a taxonomic paper on the Braconidae. It is the purpose of this paper to show how Ross' modification applies to the various types of braconid wings, and thus make it available to taxonomic workers in that family. I intend to use it in a forthcoming paper revising certain braconid genera.

In a few cases where complex serial veins occur it will probably be suggested by some, as it has been in the past, that this system is too cumbersome. For this reason shortened designations are proposed in this paper for optional use in descriptions (Table I), thus preserving the best features of the old and new systems. I am aware that this concession also will bring criticism, but feel that the advantages of the new system, even thus modified, outweigh any valid objections.

The venation of even the most primitive braconid front wing is much reduced when compared with that of the sawflies. Costa, subcosta and radius are pressed together along the anterior margin of the wing proximad of the large stigma. The stigma is composed largely of subcosta, with R_1 extending along the posterior edge. The branches of radius that remain are R_1, as mentioned above, and the first branch of the radial sector (R_s). Media is unbranched, and is joined with first cubitus for almost the proximal third of its length. First cubitus is branched into Cu_{1a} and Cu_{1b} at its distal end, although Cu_{1b} may be very faint or absent. Second cubitus, if actually present, is probably represented by a concave furrow. In most genera only one anal vein is present, and this probably represents fused 1A and 2A. In a few cases 2A branches off separately, and some genera exhibit a weak 3A. The cross-veins usually present in the braconid front wing are 2r, 2r−m, 3r−m, m−cu and cu−a. However, as will be pointed out below, it is possible that 2r−m is absent in some genera. *Helcon* possesses an anal cross-vein.

EXPLANATION OF PLATE I

Front Wings. Fig. 1. Hypothetical hymenopterous wing (after Ross, 1936). Fig. 2. *Alysia ridibunda* Say (Alysiinae), freak. Fig. 3. *Cardiochiles* sp. (Cardiochilinae). Fig. 4. *Earinus* sp. (Braconinae), freak.


Sc2
Rs1
Rs2
R1
Sc1
Sc3
1r
2r
C
Sc2
Rs
Rs+M
Rs
3r-m
2r-m
M
A
M
R
M
M
M+Cu1
Cu1
1m-cu
2m-cu
Cu
1A
2A
4A
Cu2
cu-a
3A
a cv
1A
Cu1b
Cu1a
2A+3A
1A+2A+3A
1
R1
2r
Rs
C+Sc+R
Rs
3r-m
M
Rs+M
2r-m
M
M
M+Cu
Cu2
m-cu
M
cu-a
Cu1b
1A+2A
Cu1a
2
[C+Sc]
2r-m&Rs
[R]
Rs+M&M
M
3
R1
stigma
2r
Rs1
Rs2
M
2r-m&Rs
3r-m
4
M
M+Cu
Cu
1m-cu
2m-cu
2A
1A+2A
3A
anal fold

Ross' hypothetical hymenopterous wing is shown in Fig. 1 with radius cross-hatched. The wing shown in Fig. 2 is easily homologized with the hypothetical type. It is a freak in that the small segment of R_s at the back of cell $1R_1$ is present (see Fig. 7 for cells), whereas it is normally gone from this species and from most other braconid wings (see Fig. 3). I was not entirely satisfied with the belief that a small segment of R_s had dropped out in the braconid wing, leaving R_s+M&M and 2r−m&R_s, until the freak was discovered with this part of R_s still present. This apparent reversion to the primitive braconid type seems to prove the identity of veins R_s+M&M and 2r−m&R_s and to lend weight to Ross' hypothetical wing, as the braconids are believed to be the link between the Symphyta and the rest of the Apocrita.

This discal area of the wing is usually the weakest part, and seems to be the place where the most recent modifications have taken place. The dashed lines in cell $1R_1$ of Figs. 3, 10, 11 and 23 represent furrows that apparently are not atrophied veins, but secondarily developed creases due to the pull of the hamuli of the hind wings (Fig. 33) on the anal fold (Fig. 4). Furrows of this type occur in many other braconid wings besides the four illustrated.

The aberration found in this specimen of *Alysia ridibunda* Say (Fig. 2) may or may not be the type noted by Schulz (1912) in *Alysia manducator* (Panzer), a common European species, and which he interpreted incorrectly, perhaps because he used the old system of venational nomenclature.

The *Earinus* wing shown in Fig. 4 is probably a freak. It shows a stub of R_{s2}, whereas this branch usually is represented in the braconids at most by a faint crease in the membrane as shown in another braconine, Fig. 6. Further, the stub that is labeled M in Fig. 4 may indicate that, in the subfamily Braconinae, media until fairly recently separated from cubitus nearer the base of the wing. Note the distinct angulation of the basal segment of M in Fig. 6. Of course this apparent stub of M in this wing of *Earinus* could be a new mutation in this one specimen.

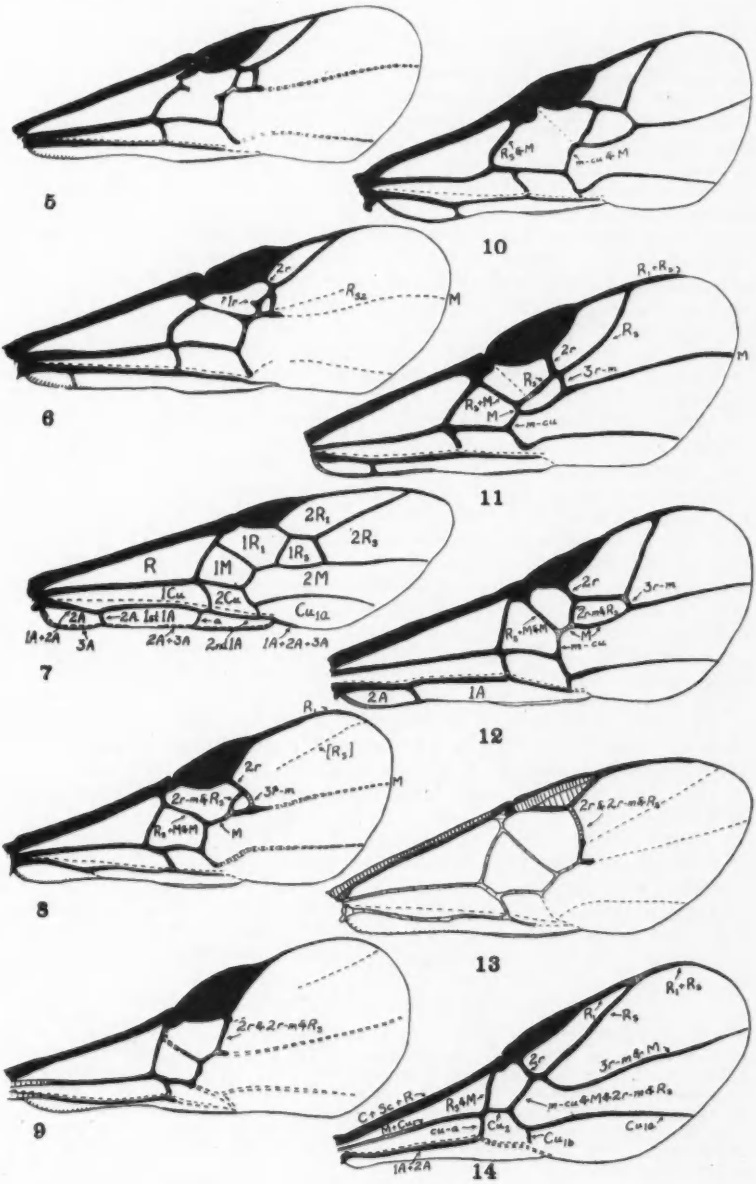
It should be emphasized that in the two freaks illustrated (Figs. 2 and 4), the variation in venation occurs in both the left and right wings.

Whiting (1921, 1924, 1926, 1932, and 1934) has illustrated variations that occurred in the wings of inbred lines of *Microbracon hebetor* (Say). He demonstrated that the tendency to lose 3r−m is inherited in *Microbracon*, although influenced by environmental conditions. Besides this condition there occurred in his stocks very rarely (on the average of about once in 10,000 insects) freak types of venation, consisting of branching of veins or their reduction or increase in number. These freak wings occurred on one side only. Breeding experiments failed to establish a Mendelian basis for these rare, one-sided freaks. Muta-

---

EXPLANATION OF PLATE II

Front Wings. Fig. 5. *Bracon haematodes* (Brullé) (Braconinae). Fig. 6. *Crassomicrodus divisus* (Cresson) (Braconinae). Fig. 7. *Helcon dentipes* Brullé (Helconinae). Fig. 8. *Microplitis melianae* Viereck (Microgasterinae). Fig. 9. *Mirax ectoedemiae* Rohwer (Microgasterinae). Fig. 10. *Chelonus annulipes* Wesmael (Cheloninae). Fig. 11. *Aridelus fisheri* (Viereck) (Euphorinae). Fig. 12. *Ichneutes* sp. (Ichneutinae). Fig. 13. *Apanteles megathymi* Riley (Microgasterinae). Fig. 14. *Paxylomma* sp. (Paxylommatinae).


5
10
6
11
7
12
8
13
9
14

tions produced in his inbred lines that altered the shape, size, condition or position of the wings are not considered here, because the basic pattern of the venation was not affected. Three mutations that appeared in his stocks that affected the venation of both wings (Reduced, Shot, and Broad) and that were inheritable, produced an appearance that, if found in specimens taken in the field (which is unlikely), would be recognized for what they are. The same is probably true of the mutation Veinless (see Martin, 1947). The mutations just mentioned do not resemble the two freaks illustrated in Figs. 2 and 4. It seems to me that some of the "freaks" that are found in nature may be the result of recessive genes that are able to express themselves after having been masked for a time during the history of the species. If this is true, some of the freaks we find, such as are shown in Figs. 2 and 4, may be employed legitimately to trace the reduction of the venation from the primitive type.

In many wings the separate elements of C+Sc+R and the stigma may be seen due to differences in pigmentation. This is diagrammed in Figs. 3, 12, and 13.

While most braconids have cell $1R_1$ shaped as in Fig. 7, in some (Figs. 11, 21, and 23) it assumes a different shape probably because the proximal end of the 1st segment of R_s (see Table I below) has migrated back along R_s+M. Such changes in position of a vein are not unknown in other Hymenoptera. The alternative interpretation is that 2r−m has dropped out instead of the small segment of R_s (see Fig. 2). While either change may have taken place, the former seems more likely. However, as no evidence for either is at hand, and in order to simplify the use of this sytem, it will be assumed that 2r−m is missing in wings of this type.

Helcon (Fig. 7) preserves the greatest number of veins in the anal area of the wing. However, the anal veins are remarkably complete in various other forms (Figs. 3, 4, 5, 6, 8, 10, 11, and 12). These remnants of 3A are best seen in wings mounted dry and studied under reflected light. *Helcon* is the only braconid genus known to the writer where the anal cross-vein is preserved, and is thus the only one with two first anal cells. In most cases the cell nomenclature is simpler as is shown in Fig. 12.

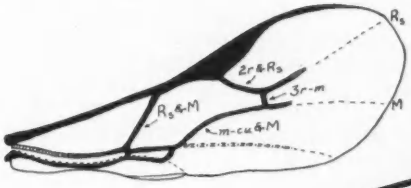
What appears to be a remnant of 1r in Fig. 6 may actually be a stub of R_s with the free end directed toward the front of the wing (compare with Fig. 2).

Great reductions in some Microgasterinae (Figs. 9 and 13) and the Paxylommatinae (Fig. 14) have resulted in several rather complex serial veins. As long as the taxonomist makes clear to his reader what

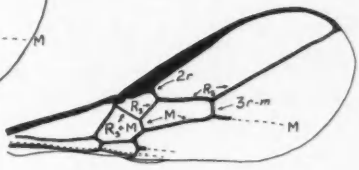
---

EXPLANATION OF PLATE III

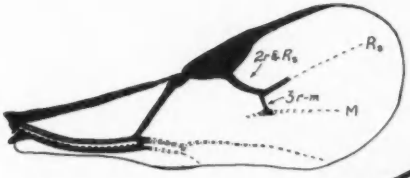
Front Wings. Fig. 15. *Aphidius ribis* Haliday (Aphidiinae). Fig. 16. *Lysiphlebus testaceipes* (Cresson) (Aphidiinae). Fig. 17. *Diaeretus rapae* (Curtis) (Aphidiinae). Fig. 18. *Chorebidea* sp. (Dacnusinae). Fig. 19. *Oenonogastra microrhopalae* (Ashmead) (Alysiinae), stigma of male. Fig. 20. *Oenonogastra microrhopalae* (Ashmead), stigma of female. Fig. 21. *Aspilota* sp. (Alysiinae). Fig. 22. *Synaldis* sp. (Alysiinae). Fig. 23. *Heterospilus languriae* (Ashmead) (Hormiinae). Fig. 24. *Aphaereta* sp. (Alysiinae). Fig. 25. *Phaenocarpa* sp. (Alysiinae), male.



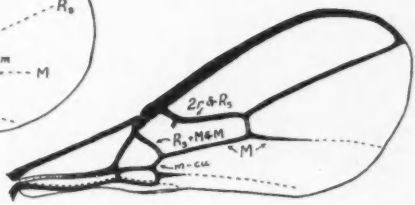
15



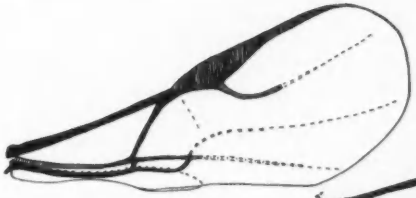
21



16



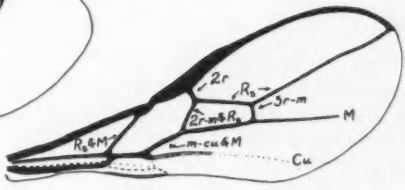
22



17

23

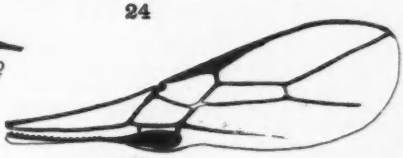
18



24

19

20



25

these veins really are, no harm will be done by using a shortened designation for them, similar to those proposed for optional use in Table I.

The dashed line posterior to M+Cu in the drawings represents a concave furrow that is probably Cu_2. This may or may not be the vannal fold of Snodgrass (1935).

The dacnusine genus *Agonia* seems to have lost cross-vein 2r, and R_s joins the stigma directly (see Nixon, 1943, Fig. 5).

TABLE I

TERMINOLOGY OF BRACONID WINGS

Actual:	Suggested for use in descriptions:
C+Sc+R	C
R_1	R_1
2r	r
1st segment of R_s	base of R_s*
2nd segment of R_s	1st segment of R_s
3rd segment of R_s	2nd segment of R_s
R_s+M&M	R_s+M
2r—m&R_s	1r—m
3r—m	2r—m
M+Cu_1	M+Cu
1st segment of M	base of M*
2nd segment of M	1st segment of M
3rd segment of M	2nd segment of M
4th segment of M	3rd segment of M
m—cu	m—cu
1st segment of Cu_1	1st segment of Cu
2nd segment of Cu_1	2nd segment of Cu
3rd segment of Cu_1	3rd segment of Cu
Cu_{1a}	Cu_{1a}
Cu_{1b}	Cu_{1b}
cu—a	cu—a
1st segment of 1A+2A	1st segment of A†
2nd segment of 1A+2A	2nd segment of A†

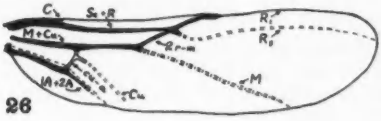
*When R_s+M&M is atrophied (as in Figs 10 and 24), R_s&M (=base of R_s and base of M) might be called the "basal vein" as it has been in the past.

†For use in wings where 2A does not branch off separately (see Figs. 2, 13, 15, etc.).

In Fig. 26 the veins of the hind wing are labeled. The cross-vein given as 2r—m is probably that and not 1r—m, as 1r—m seems to be absent from the cephids, which are probably the closest relatives of braconids among the sawflies (see Ross, 1937, Fig. 175). Note that in *Crassomicrodus* (Fig. 26) and *Bracon* (Fig. 27) part of Cu is preserved.

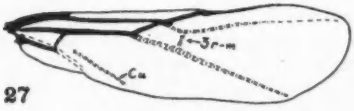
EXPLANATION OF PLATE IV

Hind Wings. Fig. 26. *Crassomicrodus divisus* (Cresson). Fig. 27. *Bracon haematodes* (Brullé). Fig. 28. *Cardiochiles* sp. Fig. 29. *Chelonus annulipes* Wesmael. Fig. 30. *Aridelus fisheri* (Viereck). Fig. 31. *Ichneutes* sp. Fig. 32. *Heterospilus languriae* (Ashmead), male. Fig. 33. *Helcon dentipes* Brullé. Fig. 34. *Atanycolus simplex* (Cresson) (Vipiinae). Fig. 35. *Alysia ridibunda* Say. Fig. 36. *Symphya ringens* (Haliday) (Dacnusinae). Fig. 37. *Microplitis melianae* Viereck. Fig. 38. *Diaeretus rapae* (Curtis). Fig. 39. *Paxylomma* sp.



26

33



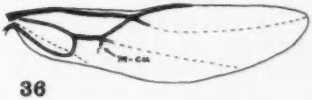
27

34

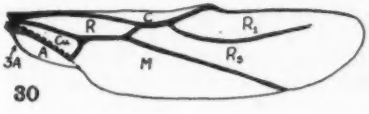
28

35

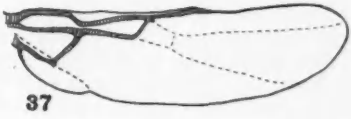
29



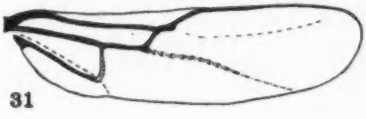
36



30



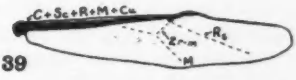
37



31

38

32



39

In *Aridelus* (Fig. 30) 3A is faintly represented. *Helcon* (Fig. 33) shows the branch of 2A as in the front wing of that genus. In some species 2r (Fig. 28) and 3r−m (Fig. 27) yet remain as slightly pigmented lines, while some alysiines (Fig. 35) and dacnusines (Fig. 36) still have a stub of m−cu. The different position of Cu&cu−a in the various wings is interesting (compare Figs. 31 and 34).

In this system the nomenclature of the cells in both the front and hind wings is very simple (see Figs. 7, 12, and 30).

The wings of braconids often show secondary sexual characters. In the genus *Oenonogastra* (Alysiinae) the stigma of the male (Fig. 19) is much more prominent than that of the female (Fig. 20), and this condition occurs in several other genera. In many species all the wing veins are heavier in the males than in the females. In some species of *Heterospilus* (Hormiinae) (Fig. 32) the males bear a large stigma in the basal area of the hind wing. This is also true of some hecabolines. (See Wilkinson, 1929, for a figure of the hind wing of *Hecabalodes anthaxiae* Wilk., male). Stelfox (1941 and 1944) has illustrated a species of *Phaenocarpa* (Alysiinae) in which there is a long, heavily sclerotized stigma in the anal area of the front wing of the male, and a similar species has been found in America (Fig. 25).

The membrane of braconid wings is usually covered with minute setae. While the membrane is ordinarily rather hyaline, in some cases it is colored, usually shades of brown, although many tropical forms have patterns of brighter color such as orange. Hoffmeyer (1932) has discussed and figured the sensilla that occur on the stigma and veins of hymenopterous wings, giving many examples from the Braconidae. A few braconids are wingless in both sexes, and some species are subapterous in one sex or the other, usually in the females.

Several braconid subfamilies are not represented in the figuers, but their venation will be comparable to one of the types shown.

The presence or absence of the various cross-veins and segments of veins has often been used in the family as the primary character for the separation of closely allied genera and subfamilies. As we learn more about these insects and investigate other structures more fully, it becomes increasingly clear that such wing characters must be used with caution. One example in the case of genera will suffice. The alysiine genus *Synaldis* is separated from *Aspilota* (Fig. 21) by the absence of the 1st segment of R_s, but I have found specimens where this vein is partially present (Fig. 22). Investigation of other characters has shown that the two genera probably will have to be recombined.

Muesebeck (1928 and 1936) already has combined several subfamilies that were separated mainly on the presence or absence of 3r−m. These were the Sigalphinae and Cheloninae, the Euphorinae and Meteorinae, and the Alysiinae and Dacnusinae.

Of course if such characters do not intergrade they probably will be retained as useful key characters. The subfamilies above might be treated as tribes. In many cases it would seem that, in the braconids at least, if two genera are separated *solely* by the presence or absence of a segment of a vein, they should be called subgenera rather than genera. This is not intended as an inflexible rule, but rather indicates that such differences in venation may have little or no fundamental phylogenetic significance.

LITERATURE CITED

André, E. 1879. Species des Hyménoptères d'Europe & d'Algérie. Beaune, Bouffant, v. 1, pp. i-cxlviii.

Burks, B. D. 1938. A study of chalcidoid wings (Hymenoptera). Ann. Ent. Soc. Amer. 31 (2): 157–161, illus.

Duncan, C. D. 1939. A contribution to the biology of North American vespine wasps. Stanford Univ. Pub., Univ. Ser., Biol. Sci. 8 (1): 1–272, illus.

Ferris, G. F. 1928. The principles of systematic entomology. Stanford Univ. Pub., Univ. Ser., Biol. Sci. 5 (3): 101–269, illus.

Haliday, M. A. 1838. Essay on the classification of parasitic Hymenoptera. Ent. Mag. 5 (3): 209–248, illus.

Hoffmeyer, E. B. 1932. Ueber Sensillen in den Hymenopteren-Flügeln. Ent. Meddel. 18: 58–74, illus.

Martin, A. 1947. An introduction to the genetics of *Habrobracon juglandis* Ashmead. New York, Hobson, 205 pp., illus.

Michener, C. D. 1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). Bul. Amer. Mus. Nat. Hist. 82 (6): 151–326, illus.

Morley, C. 1909. A description of the superior wing of the Hymenoptera, with a view to giving a simpler and more certain nomenclature to the alary system of Jurine. Trans. Ent. Soc. London 1909 (4): 439–447, illus.

Muesebeck, C. F. W. 1928. Family Braconidae. *In* Leonard, M. D., A list of the insects of New York. Mem. Cornell Univ. Agr. Exp. Sta. 101: 895–920.

1936. The genera of parasitic wasps of the braconid subfamily Euphorinae, with a review of the nearctic species. Misc. Pub. U. S. Dept. Agr. 241, 37 pp., illus.

Nixon, G. E. J. 1943. A revision of the European Dacnusini (Hym., Braconidae, Dacnusinae). Ent. Monthly Mag. 79: 20–34, illus.

Rohwer, S. A., and **A. B. Gahan.** 1916. Horismology of the hymenopterous wing. Proc. Ent. Soc. Washington 18: 20–76, illus.

Ross, H. H. 1936. The ancestry and wing venation of the Hymenoptera. Ann. Ent. Soc. Amer. 29 (1): 99–111, illus.

1937. A generic classification of the nearctic sawflies (Hymenoptera, Symphyta). Ill. Biol. Monog. 15 (2): 1–173, illus.

Schulz, W. A. 1912. Etwas über Alysiiden. Zool. Anz. 39: 74–78, illus.

Shuckard, W. E. 1836. A description of the superior wing of the Hymenoptera, with a view to give a fuller and more certain development to the alary system of Jurine. Trans. Ent. Soc. London 1: 208–214, with 1 folding table.

Snodgrass, R. E. 1935. Principles of insect morphology. New York and London, McGraw-Hill, 667 pp., illus.

Stelfox, A. W. 1941. Descriptions of five new species of Alysiidae (Hymenoptera) and notes on some others. Proc. R. Irish Acad. 47B (1): 1–16, illus.

1944. On the specific identity of *Phaenocarpa nimia* Stelfox, ♂, with *Phaenocarpa eunice* (Hal.), ♀ (Hym., Alysiidae). Ent. Monthly Mag. 80: 69.

Whiting, P. W. 1921. Heredity in wasps. Jour. Heredity 12 (6): 262–266, illus.

1924. Defective and freak venation in the parasitic wasp *Habrobracon juglandis* (Ashm.). Univ. Iowa Studies in Child Welfare 3 (1): 1–80, illus.

1926. Two wing mutations in Habrobracon and their method of inheritance. Amer. Nat. 60 (670): 443–454, illus.

1932. Mutants in Habrobracon. Genetics 17: 1–30, illus.

1934. Mutants in Habrobracon, II. Genetics 19: 268–291, illus.

Wilkinson, D. S. 1927. Eight new species of Braconidae. Bul. Ent. Res. 18: 33–46, illus.

1929. New parasitic Hymenoptera and notes on other species. Bul. Ent. Res. 20: 103–114, illus.

NOTES ON THE APACHE WASP[1] IN CALIFORNIA

PEREZ SIMMONS AND CHARLES K. FISHER
United States Department of Agriculture, Agricultural Research Administration,
Bureau of Entomology and Plant Quarantine
AND
JOHN G. TYLER
California Fig Institute

Fig growers in the vicinity of Fresno, Calif., have reported injuries to harvest workers by wasps that build their nests in the fig trees. Stinging of workers is especially likely to occur in September and October, when the trees are shaken with long-handled hooks or are jarred with padded bumping poles to dislodge the figs. At that time the wasp colonies are large, and because the daytime temperatures are still high, the insects are active and aggressive when disturbed.

As the wasps are locally a perennial nuisance, the writers decided to make observations on their life history. Collections of the single-layered paper combs were made at intervals of about a week from April 21 to June 23, 1945, and from April 17 to May 15, 1946. Two hundred seventy-four nests were removed from fig trees and records were made as shown in Table I.

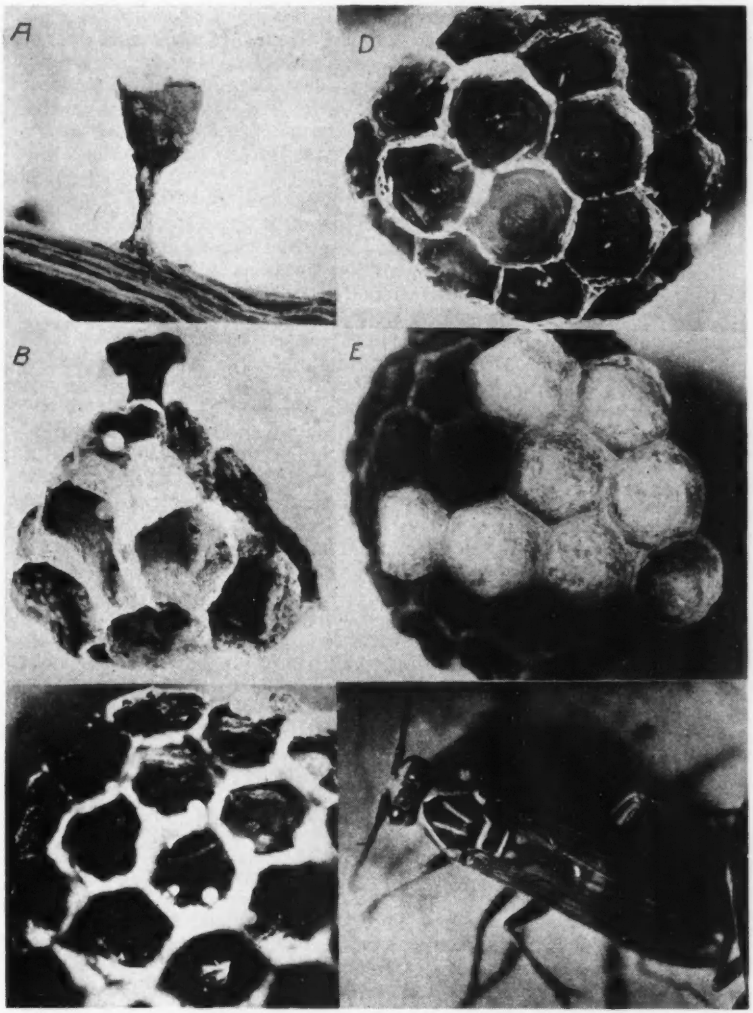
Nests or combs.—Construction of the combs begins at about the time the leaves of Calimyrna fig trees are an inch or two long. It is done, presumably, by fertilized overwintered females; however, this point was not investigated. As a rule from two to six wasps cooperate in the work of building the nests in the spring. Very small nests are the domiciles of only one or two wasps; larger ones harbor six or seven. The location favored by this species is at the top of the low trees.

Gathering of the small combs during the spring and early summer was done without much danger of being attacked. With the handle of an insect net the collector rapped on the limb bearing the nest, causing the insects to fly away or to circle briefly in the air nearby. Before they returned, the comb was scraped off with the rim of the net, into which it would usually fall. Frequently the nests were picked off by hand after the wasps had been scared away.

The wasps usually returned to the nest location and clustered there, sometimes for several days. New nests were often built within a week in trees from which all combs had been removed. Four was the maximum number of small nests found in a tree at one time.

Construction usually begins with a single cell on a slender pedicel (Plate I, A), although some nests appear to have been started as a pair of cells on a single stalk. Other cells are built onto the original cell or cells. As the comb increases in size the cell walls are built higher, the pedicel is strengthened, and the base of the comb is thickened progressively.

[1] *Polistes apachus* Sauss., family Vespidae. Two lots of these wasps were identified by H. K. Townes in September, 1944, and July, 1945.



A. *Polistes apachus* nest on a first-crop fig, showing construction of the first cell of a comb. B. Small nest of Apache wasp, with eggs. C. Nest showing eggs and deposits of honey. D. Large larvae of Apache wasp, nearly ready to seal cells. All six larvae in focus are facing inward. E. Cells capped with silk by larvae. F. Apache wasp feeding on honey.

In small nests consisting of up to 20 cells, each cell measures 4 to 5 mm. inside diameter. In some combs the hexagonal shape of the cells is likewise evident in the outline of the comb. Many combs are of course irregular, but the six-sided character of others is readily apparent.

A comb 1 inch in diameter contains about 30 cells. An hexagonal nest 5 inches in diameter is perhaps an average maximum size and contains about 320 cells. Combs as large as 6 by 7½ inches occur. A considerable number of old nests persist on the trees through the winter, or longer.

Most nests are attached to small branches, but large branches may be chosen, sometimes within 4 or 5 feet of the ground. Occasionally small combs are built on green figs. None has been found on the blades of leaves, but one was attached to a leaf petiole. A common location is inside the paper bags that are fastened to the trees for holding caprifigs.

The material used for making the nests is of various shades of gray, usually dark gray, but in small nests the paper is sometimes very light in color. Bands of contrasting shades can often be seen. The source of the woody material gathered and processed by the wasps has not been determined, but scarified areas on the weathered paper of old caprification bags suggest that the bags provide some of the raw material.

Adults confined in a glass-topped box in the laboratory and provided with a small nest, green blotting paper, honey, and water did not reproduce, but they used the blotting paper for making green additions to some of the walls of the nest.

Food storage.—Drops of sweet materials, "honey", were found in some of the cells, beginning early in the season. Occurrence of the drops was very irregular, some nests containing many and others none. The drops were of various colors, consistencies, and flavors. Some were clear and soft (Plate I, C), and tasted like honey; some were amber; others were white, opaque, and firm; still others appeared to be black; all were sweet. The dark material, in texture like caramel candy, was deep purple when examined under a microscope. Its flavor was like that of blackberries.

On a few occasions a small wasp larva was seen with its head immersed in a drop of soft honey.

Data show that "honey" was most plentiful when eggs and young larvae of the first brood occupied the combs (Table I).

The group of wasps held in confinement, as described above, used a part of their ration for storing drops of honey in the cells of the nest.

Eggs.—Laying of eggs begins when there are only two or three cells in the combs. The white eggs (Plate I, B) are glued at one end to a side of the cell, near the base, and in small nests they usually are attached to the cell surface nearest the center of the comb (Plate I, C). As the central area of the comb becomes occupied by developing brood, cells are added to the periphery. These new ones are used for further oviposition. On rare occasions two eggs are deposited in a cell.

In the spring of 1945 eggs were first observed in new nests on April 17. A search of old nests at that time revealed only one with eggs, but the following year old nests were rather commonly utilized by the wasps. A few new nests containing eggs and small larvae were collected in 1947 on April 17.

Larvae.—Newly hatched larvae are held to the cell wall by the eggshell in which they developed. White at first, they assume a pinkish cast as they increase in size, but later the rosy color disappears. For a time the larvae may be compared to the clapper in a bell; the process by which they accomplish molting without falling out of the cell would be interesting to follow through. When fully grown (Plate I, D) and filling the cells snugly, their upsidedown life seems less precarious. Only an occasional large larva falls out when a nest is knocked to the ground.

TABLE I

CONDITIONS FOUND IN NESTS OF THE APACHE WASP COLLECTED FROM FIG TREES IN 1945 AND 1946

DATE	NUMBER OF NESTS EXAMINED	AVERAGE NUMBER PER NEST							
		Cells	Eggs	Larvae			Capped Cells	Cells with Honey[3]	Drops of Honey
				Small	Medium	Large			
1945									
April 21	21	5.4 (2–16)	5.3	0	0	0	0	0.3	0.3 (0– 4)
27	22	9.5 (3–32)	9.4	0	0	0	0	1.4	1.5 (0– 8)
May 5[2]	12	20.4 (6–34)	14.7	3	1.9	0	0	2.8	3.2 (0–11)
5	15	14.1 (1–23)	11.0	2	0.7	0	0	4.3	5.0 (0–18)
12	30	22.5 (3–47)	8.4	7.4	3.2	2.8	0	1.1	1.6 (0–14)
21	17	22.9 (3–46)	7.0	4.8	3.2	3.2	0.8	0.1	0.1 (0– 1)
28	20	19.6 (7–38)	6.6	2.8	3.0	2.6	1.0	1.5	2.2 (0–21)
June 4	16	23.7 (8–49)	14.5	1.7	1.2	2.4	0.3	0.3	0.3 (0– 3)
12	9	29.0 (10–50)	13.5	1.8	2.9	1.1	0.8	2.3	3.2 (0–16)
23	12	26.0 (5–68)	9.9	3.1	4.3	0.4	3.7	1.5	1.7 (0–13)
Total	174								
1946									
April 17	25	8.8 (2–21)	8.2	0	0	0	0	0.2	0.2 (0– 2)
24	36	15.7 (3–29)	15.2	0	0	0	0	4.6	6.0 (0–24)
May 1	15	21.0 (10–42)	17.3	3	0	0	0	1.5	1.8 (0–11)
15	24	26.2 (6–48)	12.0	4.7	4.8	2.9	0.8	0.5	0.5 (0– 5)
Total	100								

[2]From rows of fig trees cleaned of nests on April 21.
[3]All deposits of sweet materials are listed as "honey."

Fully developed larvae close their cells with a cap of white silk (Plate I, E). Some caps are flat and others dome-shaped. Judging from the data in the table, larvae appear in the spring 14 days or more after eggs are laid. They begin to cap their cells about a month after egg deposition starts.

Adults.—Apache wasps (Plate I, F) are attractively colored insects, golden brown with conspicuous markings of light yellow, with smoky-amber wings, and with grey or black eyes. They vary in length, the largest being about seven-eighths inch long.

On warm days these wasps are commonly seen cruising around fig trees at a height of 10 or 15 feet above the ground. They are rendered

inactive by even moderately cool weather. When fig trees are jarred early in the morning in September, the wasps fall to the ground and may be seen crawling toward the trunk of the home tree.

In the orchard where most of our observations were made, nests of the Apache wasp were most plentiful along the north and east sides, next to an irrigation ditch. On August 11, 1944, twenty trees along the north edge contained 22 nests; about three-quarters of them were inhabited.

When a nest is removed in September, the adults return to the nest site and cluster there for weeks without rebuilding.

Few observations on the sexes were made. By July 17, 1945, males had emerged from nearly all nests held in the laboratory for observation.

The adults confined in a glass-topped box, mentioned above, lived on a diet of honey and water for not more than about 75 days, from about July 7 until September 20.

Natural enemies.—One species of parasite, identified by H. K. Townes as *Polistiphaga fulva* (Cr.), family Ichneumonidae, emerged in the laboratory from a nest collected on a building in a residential district of Fresno. A total of 15 specimens emerged from the comb, which contained numerous capped cells.

Damage to combs in fig trees was quite common on May 21, 1945. Remains of wasp larvae in damaged combs, and the irregular tearing of the paper cells suggested the work of birds. Some combs were found that had been stripped of cell walls, leaving only their thickened bases.

Control.—Attempts were made in the spring to attract the adults to baits in order to reduce the numbers before nest-building began. Beef liver, honey, and sweet ant poisons were tried without success. Sticky boards baited with honey and hung in the trees were likewise unattractive.

Burning the nests with a solid fuel, known as Heatabs, was tried. The tablets were placed in a can attached to a pole, ignited, and the alcohol-like flame was held under the nests. Some adults and brood were killed, but the nests smoldered instead of burning. Some of the larvae which remained in scorched nests were able to cap their cells.

Dust containing 10 percent DDT was applied liberally to nine nests on August 22, 1947, by means of a hand duster equipped with an 8-foot extension tube. Four days later six of the nests were free of adults. When dusted nests were held in the laboratory, it was found that emergence from capped cells continued without apparent handicap from the dust, but that the newly emerged wasps died within a few days.

Distribution.—C. F. W. Muesebeck reported that the species "is common in Texas and also occurs in Kansas, Colorado, Arizona, New Mexico, Iowa, southern Utah, and Mexico, but we have had no specimens previously from California."

Richard M. Bohart, of the University of California at Davis, in August 1946 requested specimens of the Apache wasp and of its nests. In his acknowledgment Professor Bohart stated that he had recently found a few other California records of the species in the collection of the California Academy of Sciences. These records were Bakersfield, Mill Creek in the San Bernardino Mountains, and Needles.

NOTES ON THE PHLEBOTOMUS OF PANAMA
(Diptera, Psychodidae)

IV. P. ATROCLAVATUS KNAB, P. CAYENNENSIS FLOCH AND ABONNENC, P. CHIAPANENSIS DAMPF AND SOME RELATED FORMS FROM THE WEST INDIES AND MEXICO[1]

G. B. FAIRCHILD AND MARSHALL HERTIG
Gorgas Memorial Laboratory, Panama

With the exception of *P. atroclavatus*, the species treated in the present paper share the character, unusual for New World *Phlebotomus*, of a comb-like row of cibarial teeth. *P. chiapanensis* Dampf, if we have correctly associated the sexes, belongs to a group including *P. stewarti* Mangabeira and Galindo, *P. vexator* Coq., *P. trinidadensis* Newstead and a number of others, to which Barreto (1946, Rev. Brasil. Biol., 6(3): 427–434) has recently given a key. Of the known females of this group none have a comb-like cibarium, although with certain marked exceptions, the spermathecae are of a type rather similar to those of *chiapanensis*.

P. ctenidophorus n. sp. is the most bizarre in respect to the cibarial comb, but unfortunately the male is unknown and nothing can be said of its possible relationships.

P. cayennensis is the first recorded species of American *Phlebotomus* to show well-marked geographic races, and two of these subspecies constitute the second known occurrence of *Phlebotomus* in the West Indies. The male genitalia of this complex are quite simple and offer few clues to possible relationships with other American species. *P. cayennensis* and its subspecies seem the closest of any New World *Phlebotomus* to the widespread *minutus* group of the Old World, though there are many points of difference.

Phlebotomus atroclavatus Knab

Plate I, Table I

1913, Ins. Ins. Mens., 1: 135–137, fig. 1 (2♂, 3♀; Gasparee Island, Trinidad, B. W. I.). Larrousse, 1921, Etude Syst. et Med. des Phlebotomes, p. 7. Dyar and Nunez Tovar, 1927, Ins. Ins. Mens., 14: 154. (Venezuela.) Costa Lima, 1932, Mem. Inst. Osw. Cruz, 25 (1): 29. Bequaert, 1938, Carnegie Inst., Washington, Pub. No. 499, p. 230. Floch and Abonnenc, 1943, Inst. Past. de la Guyane, Pub. No. 62, p. 6 (in key). Barretto, 1947, Arq. Zool. S. Paulo, 5 (4): 186. Dampf, 1947, Rev. Ent. 18 (3): 296–305, figs. 1–7.

Phlebotomus (*Sergentomyia*) *atroclavata*, Franca and Parrot, 1921, Arch. Insts. Pasteur de l'Afrique du Nord, 1: 284.

Phlebotomus (*Neophlebotomus*) *atroclavatus*, Dyar, 1929, Amer. J. Hygiene, 10 (1): 120.

---

[1]This work was initiated under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the Gorgas Memorial Laboratory. Cost of publication is paid by the Gorgas Memorial Institute.

Phlebotomus tejerae Larrousse, 1921, Etude Syst. Med. des Phlebotomes, p. 71; 1922 Bull. Soc. Zool. France, 47: 41. Nunez Tovar, 1924, Mosq. y Phlebot. de Venezuela, p. 42 (♂, Venezuela). Galliard, 1934, Ann. Parasit. Hum. Comp., 12: 197–199, fig. 2. (Types ♂, ♀.)

Phlebotomus guadeloupensis Floch and Abonnenc, 1945, Inst. Pasteur de la Guyane, Pub. No. 96, pp. 1–3, fig. 1 (♂, ♀; Petits Abymes and Grands Fonds du Moule, Guadeloupe Is., French West Indies, in cavities in trees); 1945, op. cit., No. 100, p. 11. Barretto, 1947, Arq. Zool. S. Paulo, 5 (4): 202.

The Types at the U. S. National Museum consist of a male labelled "Holotype", (actually Lectotype) No. 16850 mounted on a slide and a female No. 16850 also mounted on a slide. The two females and a male preserved dry mentioned by Knab appear to have been subse-

TABLE I

MEASUREMENTS IN MICRA

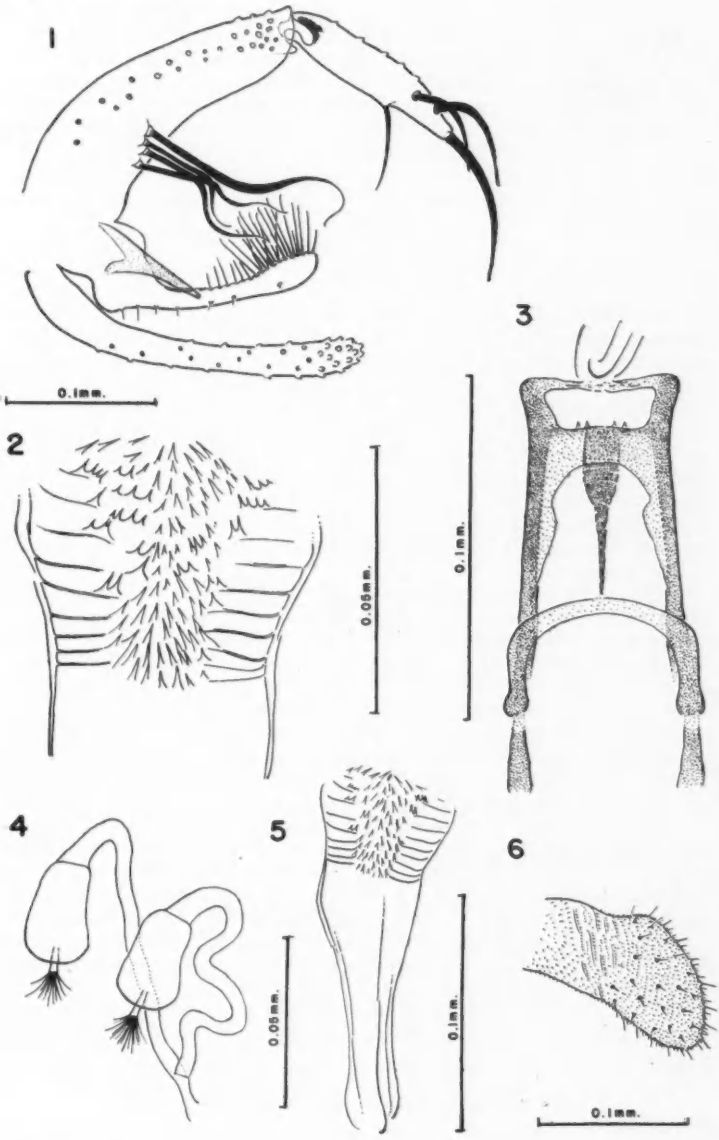
	P. atroclavatus						*P. chiapanensis*						*P. ctenidophorus*
	Maximum		Minimum		Mean		Maximum		Minimum		Mean		
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♀
Ant. III	240	228	212	208	228	220	228	220	200	188	213	204	356
Palps I–II	120	140	100	128	116	133	140	152	124	136	135	145	180
" III	148	164	132	148	140	158	152	160	140	152	148	153	184
" IV	96	112	80	100	88	104	124	124	108	116	115	120	124
" V	328	400	240	348	284	377	356	356	272	296	324	328	380
Head height	224	240	208	212	216	221	232	260	232	240	232	247	288
Clypeus	116	120	100	108	108	112	144	160	140	128	141	141	132
Proboscis	152	168	152	152	152	160	188	252	160	220	178	234	232
Eye height	180	168	160	152	168	160	176	192	152	156	165	174	180
Wing length	1728	1656	1314	1476	1476	1566	1620	1890	1530	1710	1559	1802	2124
Alpha	342	468	270	378	306	414	270	342	198	234	227	290	594
Beta	288	324	198	270	234	288	252	306	234	288	245	293	306
Gamma	270	324	198	234	216	270	396	414	342	360	371	392	324
Delta	144	252	72	162	108	198	+36	72	−36	−36	5	29	234

quently mounted and the male, at least, has been labelled as "Paratype". Other material from Venezuela identified as *atroclavatus*, presumably by Dyar, is also present. Only the Lectotype is actually *atroclavatus*. The female from the type lot as well as several females from Venezuela are *cayennensis* Floch and Abonnenc, a species we have often found associated with *atroclavatus* in Panama and which is discussed in the latter part of this paper. The male "Paratype" and four males from Venezuela are again different, being close to or the same as *trinidadensis* Newst.

The species has been often misunderstood, as Knab's description was quite inadequate, only the styles of the genitalia being correctly

EXPLANATION OF PLATE I

Phlebotomus atroclavatus Knab. Fig. 1. Male genitalia, inner aspect. Fig. 2. Apex of female pharynx. Fig. 3. Female cibarium. Fig. 4. Spermathecae. Fig. 5. Entire female pharynx. Fig. 6. Female cercus.


1
0.1mm.
2
0.05mm.
0.1mm.
3
4
5
0.05mm.
0.1mm.
6
0.1mm.

figured. Knab either failed to see or attached no importance to the basal tuft on the coxite, which is readily visible in his specimen. Floch and Abonnenc's description and figures of ***guadeloupensis*** are excellent, and the female they associate with the male appears to be the same as the one which we have also concluded was the correct one. Galliard's description and figures of the female cotype of ***tejerae*** are also in agreement. The description of the male ***tejerae*** Larrouse we have not seen, though the figure given by Nunez-Tovar of the style is characteristic for the present species and we see no reason for not accepting Dyar's synonymy.

We give here figures of the male genitalia (fig. 1), cibarium (fig. 3), pharynx (figs. 2, 5), spermathecae (fig. 4) and cercus (fig. 6) as well as measurements (Table I) of Panamanian material. The cibarium is quite characteristic, there being a large number of very small erect spines in transverse rows below the four small horizontal spines. These are difficult to see, and even more difficult to portray, as they are obscured by the large pigmented patch. The chitinous arch is well-defined, though poorly sclerotized, and is unusually far distal in position. The genital filaments are rather short, being but slightly longer than the coxite and style and about 3 times as long as the genital pump. The pharynx is quite unique with its evenly spaced transverse ridges, heavy spines, and basal pigmented area. The ascoids are simple, without posterior prolongations, about one third the length of their respective antennal segments in the male, but reaching to the end of the segment in the female.

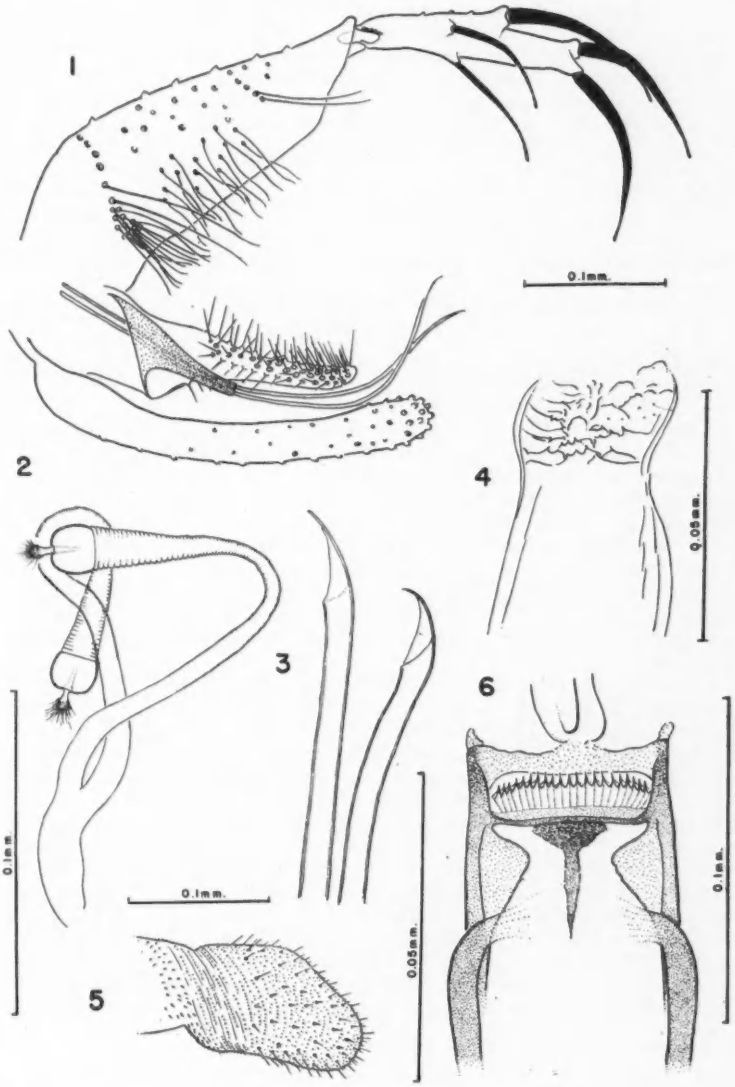
The species is quite abundant in holes and crevices in the walls of the ruins of Old Panama, and we have taken it there in nearly every month of the year. We have also taken it in a wooden building on Chepillo Island at the mouth of the Rio Bayano, on San Jose Island, one of the Pearl Islands in Panama Bay, in a shallow sea cave, and on Taboga Island in tree buttresses. Floch and Abonnenc's material came from hollows in trees on Guadeloupe Island, French West Indies. We have no evidence as to the preferred hosts, but the pronounced maritime distribution is rather striking, all our material having come from islands or from very close to the sea.

The treatment of ***cayennensis*** and the following three forms as subspecies may seem a bit radical, but we feel that this is the best way to indicate their relationship. The differences noted between them are slight though constant, confined to one sex, and correlated with their geographical distribution. Full specific status for each form is impractical, as the males appear to be indistinguishable, while lumping all four together as a single species ignores the quite definite and constant differences in the females.

The occurrence of ***Phlebotomus*** in Puerto Rico is of some interest, as it is the second instance of finding the genus in the West Indies.

EXPLANATION OF PLATE II

Phlebotomus chiapanensis Dampf. Fig. 1. Male genitalia, inner aspect. Fig. 2. Spermathecae. Fig. 3. Tips of genital filaments. Fig. 4. Apex of female pharynx. Fig. 5. Female cercus. Fig. 6. Female cibarium.


1
0.1mm.
2
4
0.05mm.
3
6
0.1mm.
0.1mm.
0.05mm.
5

P. atroclavatus, from Guadeloupe is the only other record to our knowledge, exclusive of the species recorded from Trinidad, which is faunistically not part of the West Indies. The occurrence of distinct races on Puerto Rico and Vieques may seem surprising, but insular races in other groups are common enough in the West Indies, and *Phlebotomus* is a rather fragile and sedentary insect. It is probable that other species occur both in Puerto Rico and other of the West Indian islands.

Aside from the typical subspecies, we have no hint as to the habits or preferred hosts of the other races. The West Indian forms were taken in situations similar to those the species selects in Panama. The Mexican material was unaccompanied by any habitat information.

The Guatemalan specimens of the same form were all from buttresses of large roadside trees in relatively open country.

Phlebotomus cayennensis cayennensis Floch and Abonnenc

Plates III, IV, and V, Table II

1941, Inst. Pasteur de la Guyane, Pub. No. 15, pp. 13–17, fig. 5 (♂, Cayenne, Fr. Guiana, in crevices in rocks near the coast); 1943, op. cit., Pub. No. 62, p. 5. Barretto, 1947, Arq. Zool. Est. S. Paulo, 5 (4), p. 192.

Although Floch and Abonnenc describe only the male, they have recently taken females and their description of this sex is to appear shortly. From sketches of the cibarium and spermathecae kindly sent us, there seems no doubt that our species is the same. They also have material from Venezuela.

A small pale brownish species with rather narrow pointed wings, four spines on the style and long fifth palpal segment.

Male.—Genitalia simple, as figured, (Pl. III, fig. 1) the genital filaments short and stout, the aedeagus long and slender. Cibarium showing vestiges of the teeth found in the female. Pharynx without the spines of the female.

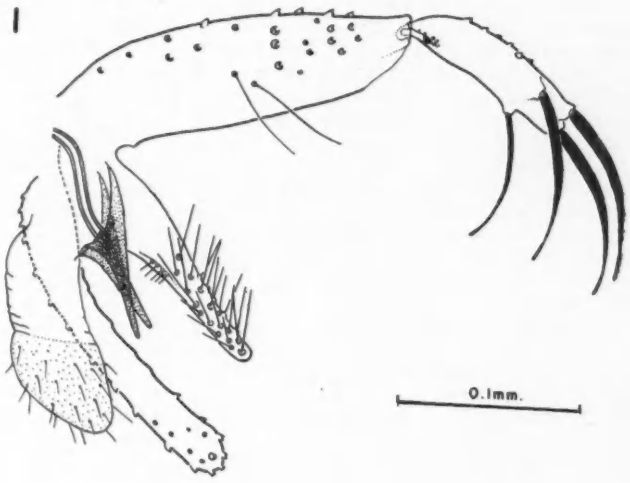
Female.—Spermathecae, (Pl. V, fig. 3), cibarium, (Pl. IV, fig. 1), pharynx, (Pl. IV, fig. 7), and cercus, (Pl. V, fig. 2), as figured. The unusual structure of the cibarial teeth, lack of chitinous arch and the strong spines in the pharynx are nearly unique among American species of *Phlebotomus*. The teeth in the cibarium number from 16 to 18 and there is a single row of minute erect teeth below. The antennae are also unusually short, the third segment being hardly one-third the length of the palpi. *Delta* is very long, generally exceeding one-half alpha, though Floch and Abonnenc show a shorter *delta* on their material. The ascoids are simple and short, not over half the length of their respective segments in all the forms.

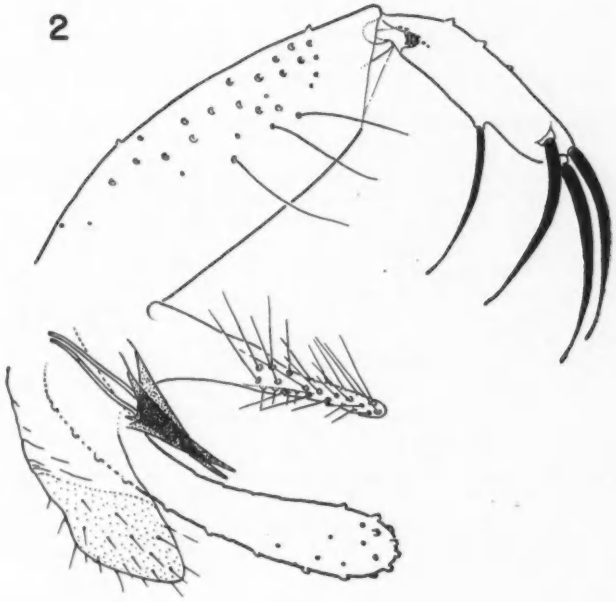
We have taken this species abundantly in holes and crevices of the ruins of Old Panama, where it is probably the dominant species. A small colony was also discovered in a ground-floor concrete-walled bathroom in the senior author's house in the outskirts of Panama City,

---

EXPLANATION OF PLATE III

Fig. 1. *Phlebotomus cayennensis cayennensis* Floch and Abonnenc, male genitalia, inner aspect. Fig. 2. *Phlebotomus cayennensis puertoricensis*, male genitalia, inner aspect.


1
0.1mm.


2

and specimens were repeatedly taken resting on the walls in the darker corners. The species has also been taken in buttresses of large trees in heavy forest near Pacora, R. P., in a hollow tree in scrubby xerophytic forest near Bejuco, R. P., in buttresses of a large tree at La Victoria, near Tocumen, R. P. at an altitude of about 2400 ft., and in holes and crevices of the ruins of Fort San Lorenzo, at the mouth of the Chagres River on the Caribbean coast. The specimen from La Victoria is ten to twenty percent smaller in all measurements than the rest of our material, and we have omitted it from the table of measurements, though we can find no structural differences. We believe it likely that the species feeds upon lizards, as these are the dominant vertebrates in its favored habitats. Specimens have been taken in most months of the year, but our data are insufficient to indicate seasonal variations in abundance, if any.

The female specimens mentioned as being part of the type series of *P. atroclavatus*, as well as several from Venezuela in the U. S. National Museum, are *P. cayennensis*, so that Trinidad and Venezuela may be added to the range of the species.

P. cayennensis does not seem closely related to any described American species. *P. minasensis* Mang. is somewhat similar, but does not have two terminal spines on the style, has a short *delta*, and a very short fourth palpal segment. *P. texanus* Dampf has a very different male with single terminal spine on the style. In the female of *texanus* the numerous cibarial teeth seem to be of different structure and there are several rows of erect teeth, lacking in our species. The spermathecae, though of similar shape, are larger and with shorter ducts, and the cerci are longer and more slender in *texanus*. In the structure of the cibarium and pharynx and, to a lesser extent, of the male genitalia, this species approaches the Old World species belonging to the *minutus* group. The spermathecae, however, are quite different.

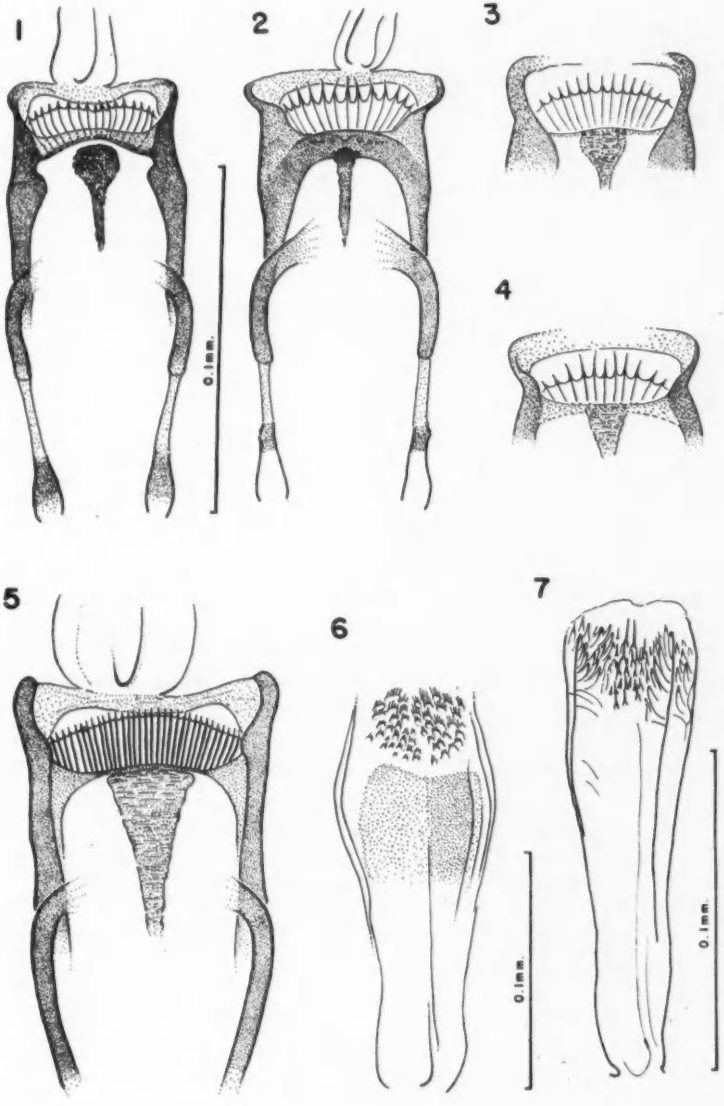
Phlebotomus cayennensis puertoricensis subsp. nov.

Plates III, IV, and V, Table II

This form differs from the typical subspecies only in details of the spermathecae (Pl. V, fig. 1), these being smaller, with longer and more slender ducts, and in having fewer (11 to 13) and longer teeth in the cibarial comb (Pl. IV, fig. 4). We have been unable to detect any erect teeth below. Measurements of wings, palpi, etc., average somewhat larger but there is considerable overlapping. We have been unable to find any characters in the male which will separate it with certainty from the males of the other subspecies, though we have the impression that the median spine of the style tends to be inserted further distally in this race.

EXPLANATION OF PLATE IV

Fig. 1. *Phlebotomus c. cayennensis* Floch and Abonnenc, female cibarium. Fig. 2. *Phlebotomus c. maciasi* subsp. nov., female cibarium. Fig. 3. *Phlebotomus c. viequesensis* subsp. nov., cibarial teeth. Fig. 4. *Phlebotomus c. puertoricensis* subsp. nov., cibarial teeth. Fig. 5. *Phlebotomus ctenidophorus* sp. nov., female cibarium. Fig. 6. Same, female pharynx. Fig. 7. *Phlebotomus c. cayennensis* Floch and Abonnenc, female pharynx.


1
2
3
4
5
6
7
0.1mm.
0.1mm.
0.1mm.

Holotype, female.—Slide 1057, Lares, Puerto Rico, 1200 ft. alt., 15 Aug. 1947, in a cave, Jose Romero coll.

Allotype, male.—Slide 1059, same data.

Paratypes.—Two males, same data as holotype; 2 males, 3 females, Lares, Puerto Rico, 3 July 1947, in a hollow "Bucal" tree, H. Trapido and Jose Romero coll.; 3 males, 2 females, Lares, Puerto Rico, 19 July 1947, Jose Romero coll.

TABLE II

MEASUREMENTS IN MICRA

	P. c. cayennensis						*P. c. maciasi*				*puertoricensis viequesensis*			
	Panama						Mexico		Guatemala		Puerto Rico		Vieques Id.	
	Maximum		Minimum		Mean		Mean		Mean		Mean		Mean	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Ant. III	196	200	172	152	194	178	198	182	194	192	200	227	214	200
Palpi I–II	128	128	108	112	119	121	120	123	117	120	130	134	122	120
" III	132	140	116	112	125	128	136	134	124	133	144	149	132	138
" IV	112	112	96	100	105	106	98	100	93	103	104	114	101	98
" V	340	336	272	273	304	302	300	321	268	313	310	336	298	310
Head ht.	216	240	208	212	211	227	212	234	205	214	224	234	224	220
Clypeus	128	140	112	108	122	126	140	125	113	130	115	129	136	138
Proboscis.	168	188	132	152	152	173	168	185	145	180	152	169	146	166
Eye ht.	184	200	160	160	165	186	172	185	168	174	174	190	164	.....
Wing	1548	1764	1494	1494	1461	1643	1584	1660	1450	1640	1631	1899	1512	1710
Alpha	378	486	324	324	343	428	405	479	396	468	396	504	414	.....
Beta	306	342	234	216	264	283	279	324	234	277	290	355	234	.....
Gamma	216	234	144	162	165	193	198	191	185	218	225	252	180	.....
Delta	216	324	162	180	189	264	279	335	253	306	230	301	234	.....

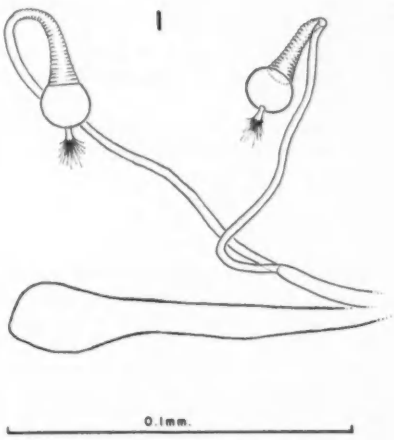
Phlebotomus cayennensis viequesensis subsp. nov.

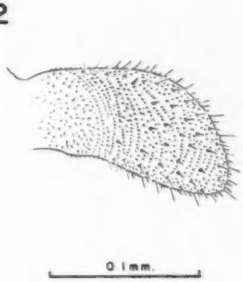
Plates III, IV, and V, Table II

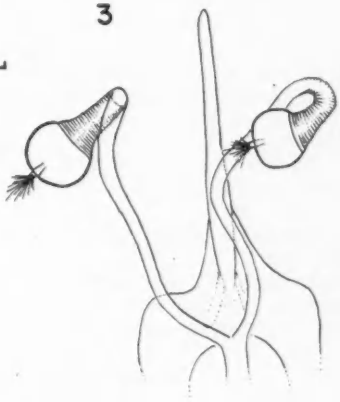
This form differs from the typical subspecies only in the structure of the spermathecae (Pl. V, fig. 4) and cibarium (Pl. IV, fig. 3) of the female. The spermathecae are considerably larger, with shorter and thicker ducts, and the cibarial teeth are longer and fewer in number. There are also four minute erect teeth in two sublateral pairs. From *P. c. puertoricensis* it differs especially in the much larger spermathecae. The cibarium also appears to have a few more teeth, 14 and 15 in the

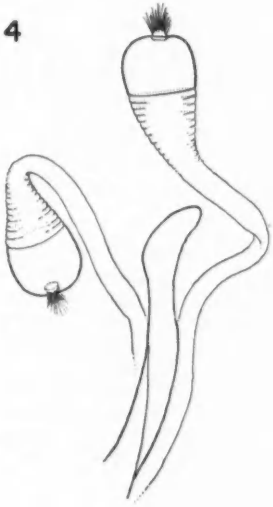
EXPLANATION OF PLATE V

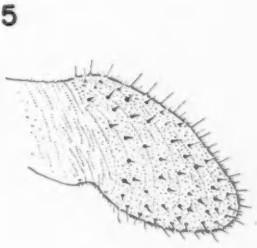
Fig. 1. *Phlebotomus c. puertoricensis* subsp. nov., spermathecae. Fig. 2. *Phlebotomus cayennensis* Floch and Abonnenc, female cercus. Fig. 3. Same, spermathecae. Fig. 4. *Phlebotomus c. viequesensis* subsp. nov., spermathecae. Fig. 5. *Phlebotomus ctenidophorus* sp. nov., female cercus.


1
0.1mm.


2
0.1mm.


3


4


5

two specimens available, but a larger series of specimens might not substantiate the slight differences indicated. This race seems smaller than the Puerto Rico form, the few measurements available showing no differences from *P. c. cayennensis*.

Holotype, female.—Slide 1051, Laguna Yanuel, Vieques Island, Puerto Rico, 17 June 1947. In a tree hole. H. Trapido and J. Andrews colls.

Paratypes.—Two males, 2 females, same data as holotype; 1 male, Isabel Segunda, Old Spanish Fort, Vieques Island, Puerto Rico, 19 June 1947. H. Trapido coll.

Phlebotomus cayennensis maciasi subsp. nov.

Plate IV, Table II

This form again differs from the typical subspecies only in characters of the female. The spermathecae are like those of the Panama subspecies, but the cibarial comb (Pl. IV, fig. 2) has much longer teeth, which tend to be fewer in number, 12 to 13 in Mexican examples, 12 to 16 in those from Guatemala. The erect teeth below the cibarial comb are larger than in Panama specimens, and the central pair are markedly larger than the others. In measurements there seem no significant differences between material from Mexico, Guatemala or Panama, though *delta* seems to average shorter in Panama material.

Holotype, female.—Slide 931, Zumpango, Guerrero, Mexico, Macias coll.

Allotype, male.—Slide 390, between Esquintla and San Jose, Guatemala, June 3, 1945, G. B. Fairchild coll. Taken in buttresses of a large roadside tree.

Paratypes.—Three males, 10 females, Zumpango Guerrero, Mexico, Macias coll.; 1 male Guerrero, Mexico; 2 males, near Esquintla, Guatemala, May 25, 1945, in buttresses of large forest trees; 2 males, 5 females between Esquintla and San Jose, Guatemala, June 3, 1945, in buttresses and hollow trees along roadside.

Phlebotomus ctenidophorus sp. nov.

Plates IV and V, Table I

We have only a single female of this species, but the structure of the cibarium (Pl. IV, fig. 5) is so unusual that we feel it should be recognizable from that alone. The cibarium is a comb-like structure bearing 34 fine teeth, the pharynx (Pl. IV, fig. 6) is armed with prominently sclerotized tubercles each bearing a row of fine spines and shows in addition a heavily pigmented patch anterior to the spines. The cerci (Pl. V, fig. 5) are of a somewhat different shape from those of *cayennensis*. The spermathecae are unfortunately badly shrunken, but appear to have been subglobose with relatively short ducts. The third antennal segment and fifth palpal segment are both quite long, while *alpha* is very long, much exceeding *beta* or *gamma*. The ascoids are simple and appear not to reach the ends of their respective antennal segments, though in our single mount they are difficult to see.

Holotype, female.—Slide, 999, Tamazunchale, San Luis Potosi, Mexico (no date), Macias coll.

We include this species here, as it seems to be related to *P. cayennensis.*

Phlebotomus chiapanensis Dampf

Plate II, Table I

1947, Medicina, Mexico, 27 (530): 3–7, figs. 1–6 (♀; Chiapa de Corzo, Chiapas, Mexico).

We at first confused this species with *cayennensis* but it is larger and with quite different wing measurements. The spermathecae (fig. 2), though superficially similar to *cayennensis* have a large setiferous knob at the apex, not shown in Dampf's figure. The reticulate appearance of the pharynx (fig. 4), emphasized by Dampf is clear in our material, but in addition there are small spines not shown by him. The cibarial comb (fig. 6) bears about 25 teeth, considerably more than in any of the forms of *cayennensis.* The ascoids are simple and reach nearly to the ends of the segments. Our material shows a shorter *delta* and *alpha* and a longer *gamma* than indicated by Dampf in his figure, but he gives no actual measurements of these vein segments. The late Dr. Dampf was kind enough to compare one of our specimens with the type and agreed that our determination is correct.

We have also taken what we believe to be the male of this species (fig. 1). It agrees in wing and palpal measurements, except for being somewhat smaller, and in well stained material vestiges of the cibarial comb may be seen. It is, however, so unlike the males of *cayennensis* that we were for long hesitant in accepting it as the proper male for the species. It is closely similar in the structure of the style to *P. stewarti* Mangabeira and Galindo, though the basal tuft on the coxite, of relatively slender scattered hairs, is reminiscent of the condition in *trinidadensis* Newst.

We have taken this species in fair abundance in crevices in the ruins of Old Panama, our records showing captures in Feb., April, June, Sept., Nov., and Dec. Dr. Galindo has taken it also at Puerto Chitre, Herrera Prov., Panama. Aug. 9, 1945 in a rodent burrow. We also have a male and a female from Barranca, Costa Rica, H. W. Kumm coll.

ARTHROPODA.—This journal is the official organ of the Asociacion Argentina de Arthropodologia. Its purpose, according to the statement of Sr. Julio A. Rosas Costa, president of the Subcommittee of Publications, is to publish original, unpublished articles on the embryology, morphology, anatomy, histology, physiology, ecology, taxonomy, systematics, zoogeography and palaeontology of arthropods of the Neotropical region, particularly of Argentina. Four numbers are to constitute the annual volume. Number one, volume one, dated November 27, 1947, contains 126 pages of text. It is well printed, except for an occasional defective letter, on a good grade of paper. The articles appear substantial, and the illustrations are good. The articles of the first issue, by F. S. Pereira, E. E. Blanchard, O. Schubart, A. Martínez, A. Ogloblin, F. Monrós, and M. A. Garriker, Jr., deal with the Hymenoptera, Coleoptera, Orthoptera, Mallophaga, and Diplopoda. Short sections are devoted to notes and book reviews. We extend our welcome and best wishes to our Argentine coworkers.—M.T.J.

LARVAL, PUPAL, AND ADULT STAGES OF NORTH AMERICAN PHYSONOTA

(Chrysomelidae)

MILTON W. SANDERSON
Illinois Natural History Survey,
Urbana, Illinois

The tortoise beetle genus *Physonota* Boheman in North and South America contains about forty species of which four or five are known to occur north of Mexico. Two of these are from the Southwest, one is recorded from California, and two occur chiefly in the East, Middle West, and eastern Canadian provinces. Representatives of four of these species have been studied.

A study of the larvae, pupae, and adult male and female genitalia has disclosed several characters which aid greatly in the recognition of our species. The study has also resulted in the clarification of the status of certain doubtful forms and has pointed out previously unrecognized relationships among our species.

Physonota unipunctata (Say) was the only species recognized in our fauna for many years, but Hamilton (1886) believed that *5-punctata* Walsh, a synonym of *helianthi* Randall, was also distinct and not a synonym of *unipunctata*. Caulfield (1884, 1886, and 1887) also believed *unipunctata* and *helianthi* were distinct. Barber (1916) suggested that *unipunctata* was probably divisible into a number of more or less distinct forms restricted to certain food plants. Criddle (1926) considered *unipunctata* and *helianthi* distinct because each had a different host. Some adult differences were described.

Through field observations and collections, and subsequent study of larvae, pupae, and adults, I have confirmed the opinions of others that *unipunctata* and *helianthi* are distinct species. They feed on different hosts, *unipunctata* on *Monarda* and *helianthi* on *Helianthus;* there are striking larval and pupal differences; and features of the male and female genitalia associate *unipunctata* with *alutacea* Boheman, and *helianthi* with *arizonense* Schaeffer. This association is also borne out by larval characters, and in pupae of three of the four species.

I am indebted to Dr. E. A. Chapin, United States National Museum, and Dr. W. H. Anderson, Bureau of Entomology and Plant Quarantine, for submitting adult, larval, and pupal material of *Physonota* for study.

CHARACTERS OF PHYSONOTA

Physonota adults known from north of Mexico have the head completely covered by the rounded pronotal margin. All the tarsal claws are simple and without basal teeth. The anterior margins of the elytra are finely crenulate, the third antennal segment in our species is distinctly longer than the second. From *Psalidonota* Boheman, it differs in not having the elytra ridged behind the scutellum, and by having the pronotum widest near base instead of in front of middle. *Physonota*

is also related to *Cassida* L. but does not have the strong pronotal punctures found in that genus, and the lateral pronotal margins of *Physonota* are not angulate.

The *Physonota* larvae studied have the mesothoracic spiracle situated below the level of the lateral thoracic spines, and the eighth abdominal segment is without lateral processes. In this feature it is similar to *Eurypepla* Boheman but has much longer caudal forks than in that genus. In *Eurypepla* the caudal fork is shallowly emarginate with each process very short.

Since there has been insufficient pupal material of other cassidiid genera for study, it has not been possible to determine the generic characters for the *Physonota* pupae studied.

KEY TO SPECIES

LARVAE

1. Prothorax with three lateral marginal spines; mesothorax and metathorax each with two marginal spines (figs. 4 and 5) 2
   Prothorax with two marginal spines; mesothorax and metathorax each with one marginal spine (fig. 3) ..... **helianthi, arizonense**
2. Thoracic spines rough in appearance, generally directed laterad, and with apical half or more of each black (fig. 4); processes of caudal fork outwardly curved; abdominal tergites with a dark spot near each spiracle; mesonotum and metanotum each with a dark diagonal mark near lateral margin ..... **unipunctata**
   Thoracic spines nearly smooth, directed caudad, and with never more than extreme apex of each dark (fig. 5); caudal fork process inwardly curved; mesonotum, metanotum, and first six abdominal tergites with conspicuous transverse bands ..... **alutacea**

PUPAE

1. First five abdominal segments each with a long lateral projection, the first four projections at least as long as the segment, as in figs. 7 and 8 2
   First four abdominal segments with short lateral projections, each not more than half as long as segment (fig. 6) ..... **helianthi**
2. Projection of first abdominal segment curved forward, the anterior margin dark and concave, posterior margin pale and convex (fig. 8); extreme tips only of projections of following three segments dark; each side of pronotum near middle with a transverse dark bar arising at margin ..... **alutacea**
   Projection of first abdominal segment directed forward then slightly recurved, the anterior margin convex and the posterior margin concave (fig. 7); lateral projections of first four segments entirely dark; pronotum pale on sides, the posterior angles dark ..... **unipunctata**

ADULTS

1. Abdomen with a broken longitudinal central and lateral dark color pattern (fig. 1); outline of body, seen from side, usually tumid (fig. 2); metasternum raised and strongly declivous on each side of meson before posterior coxae, the lateral side of declivity almost perpendicular, and with angle of ridge usually bearing a small posteriorly directed angular projection ..... **alutacea**
   Abdominal sternites nearly uniformly dark to yellow, but with dark areas generally arranged in even transverse bands on anterior margins of sternites II to V; body never tumid; metasternum slightly to rather strongly raised, the lateral sides gradually sloping and without angular projection at apex of ridge 2
2. Abdomen yellow with a short transverse dark mark on each sternite near lateral margin; pronotum with three dark longitudinal marks, the median one four to six times longer than wide ..... **arizonense**
   Abdomen entirely dark, or with posterior margins and frequently metacoxal process of sternites pale 3

3. Pronotum with three distinct dark spots, two basal and one median, and frequently an occasionally divided dark area in front of median spot; elytra often mottled with creamy spots; metasternum, on side, nearly evenly curved from front to posterior margin and scarcely evident as a ridge..... **helianthi**

Pronotum with a single median dark spot; elytra nearly uniformly greyish yellow, unmottled; metasternum on side generally appearing as a distinct ridge..... **unipunctata**

Physonota helianthi (Randall)

Cassida helianthi Randall (1838, p. 30).
Physonota septentrionalis Boheman (1862, p. 245).
Cassida quinquepunctata Walsh (1869a, p. 235).
Physonota quinquepunctata Walsh (1869b, p. 4).

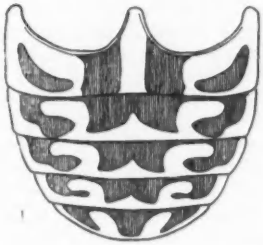
Larva (fig. 3).—Length 11 mm. Prothorax with two lateral spines, mesothorax and metathorax each with one lateral spine; first seven abdominal segments each with a lateral spine, these sometimes absent on first segment and occasionally present on 8th segment. In last instar thoracic spines dark at base and apex, but nearly uniformly brownish in earlier instars. Spines nearly straight and smooth, and provided with a few hairs, the abdominal spines generally directed caudad. Caudal fork subparallel in basal two thirds, each process outwardly curved in apical third. Upper surface of body light, lateral margins dark; mesothorax and metathorax generally with two dark discal areas; dark areas on margins of abdomen sometimes united caudally on upper and undersides. Head brown, mottled with darker brown; legs brown, apical segment darker; caudal fork of last instar light in basal two thirds, black at apex.

Pupa (fig. 6). Length 8 mm. Upper surface of mature pupa pale yellow except as follows: pronotum with a median dark longitudinal spot, a subbassal dark spot about midway between meson and lateral angles, and a transverse slightly sinuate mark arising on lateral margin and extending mesad. Wing pad with a single dark band along posterior margin. Metanotum with a dark mark on each side. First three abdominal segments with short lateral projections, the following two segments with smaller swellings; first six abdominal tergites each with an irregular, medially interrupted transverse band.

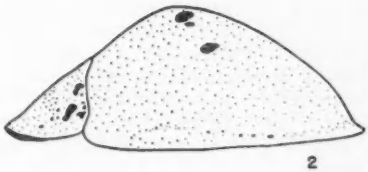
Adult.—Length 8–12 mm.; width 6–7 mm. General color similar to that of *unipunctata* but differing as follows: pronotum with three distinct dark spots, one about the middle and one each in front of basal margin about half way between meson and lateral margin; elytra usually distinctly mottled with creamy yellow spots. Scutellum usually wider than long. Internal sutural margin of elytra nearly concolorous with elytra. Venter similarly colored to that of *unipunctata*. Legs nearly similarly colored but posterior face of tibia almost entirely pale; outer margin usually dark. Metasternum nearly evenly

EXPLANATION OF PLATE I

Fig. 1. *Physonota alutacea*. Abdomen of adult. Fig. 2. *Physonota alutacea*. Lateral aspect of adult from Honduras. Fig. 3. *Physonota helianthi*. Larva, dorsal aspect. Fig. 4. *Physonota unipunctata*. Larva, dorsal aspect. Fig. 5. *Physonota alutacea*. Larva, dorsal aspect. Fig. 6. *Physonota helianthi*. Pupa, dorsal aspect. Fig. 7. *Physonota unipunctata*. Pupa, dorsal aspect. Fig. 8. *Physonota alutacea*. Pupa, dorsal aspect. (Figs. 3–5, legs not shown.)

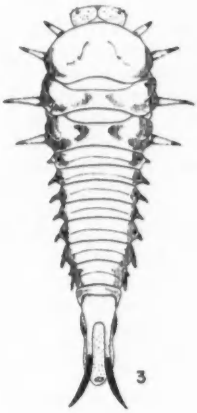


ALUTACEA



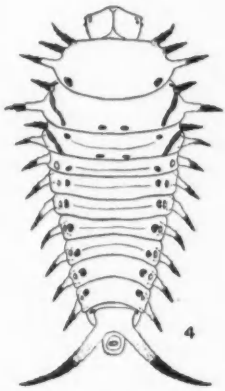
2

ALUTACEA



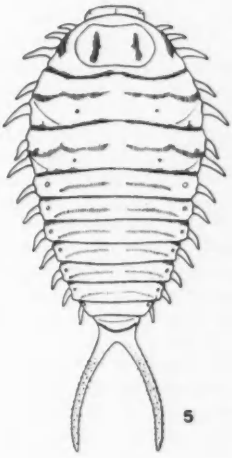
3

HELIANTHI



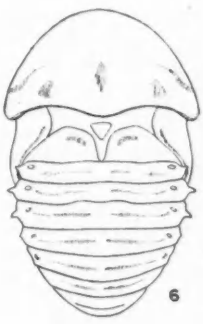
4

UNIPUNCTATA



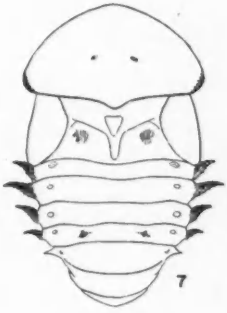
5

ALUTACEA



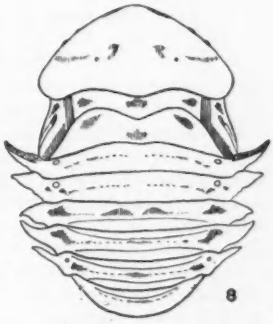
6

HELIANTHI



7

UNIPUNCTATA



8

ALUTACEA

curved on side from middle to posterior coxa. Spermatheca of female genitalia (figs. 14 and 14A) not constricted before the opening to spermathecal duct; duct in part parallel to spermatheca and extremely and narrowly convoluted beyond region of spermatheca; bulbous part of spermatheca with a variable collar or sheath; apex of spermatheca blunt and covered internally with a sheath. Two females, one from Illinois, the other from Manitoba, are illustrated to show individual variation. Male genitalia in lateral view (fig. 9) curved, dorsally convex, pointed and slightly upturned at apex. In dorsal view (fig. 9A), apex of aedeagus gradually narrowed. One male collected at Montreal, Quebec, in September is strongly iridescent above. Retracted aedeagus with a long awl shaped process (figs. 9B and 9C).

*P. **quinquepunctata*** Walsh was originally described from larvae and adults, collected near Rock Island, Illinois, in a footnote to a paper on sweetpotato insects. Subsequently a fuller description of this insect was given by Walsh (1869b, p. 4), and was accompanied by illustrations of the adult and larva. The figures clearly show the elytral spotting of some individuals of ***helianthi***, and the arrangement and shapes of the spines and caudal fork typical of the larva of ***helianthi***. I believe ***quinquepunctata*** is a synonym of that species. An examination of the description of *P. **septentionalis*** Boheman appears to indicate its synonymy with ***helianthi***. The anterior tibia is described as being externally infuscate, a character always found in ***helianthi*** but not observed in ***unipunctata***.

Adults of this species resemble ***unipunctata*** and the two have been confused in collections. Reference to the descriptive notes under ***unipunctata*** will aid in distinguishing the two. *P. **helianthi*** is closer to ***arizonense*** but is distinguished by having at least the entire anterior margins of abdominal sternites II to V dark. In ***arizonense***, these sternites are pale except for a narrow transverse mark near each lateral margin.

Records.—Larvae, June, July, September; pupae, July, September; adults, May to September. Illinois, Indiana, Kansas, Maine, Manitoba, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Tennessee, and Quebec.

*Hosts.—**Helianthus, Heliopsis.***

Physonota arizonense Schaeffer

Physonota unipunctata arizonense Schaeffer (1925, p. 234).

Larva.—Length 5.5 mm. to base of caudal fork, 8 mm. to apex of fork. One individual believed to be about a third instar, has been examined, and it is of the same type as ***helianthi***. The prothorax has two straight spines on each lateral margin, and the mesothorax and metathorax have one each on each side. The first seven abdominal segments have a distinct spine on each lateral margin; the caudal fork is of the same type as in ***helianthi***, but the two processes are nearly straight and only slightly curved outwardly at their apexes.

Pupa.—Unknown.

Adult.—Length 11–13 mm.; width 7.5–8.5 mm. Similar in general color to ***unipunctata*** and ***helianthi***. Pronotum with three dark spots, as in ***helianthi***, the median spot four to six times longer than wide.

Elytra occasionally faintly mottled with creamy white. Scutellum nearly equilateral. Legs largely pale, sometimes with the outer margin of femur near joint, and outer tibial margin, dark. Metasternum rounded on side and evenly curved as in ***helianthi***. Abdomen pale, the first four segments with a narrow transverse dark mark near each lateral margin. Spermatheca (figs. 15 and 15A) similar in general features to that of ***helianthi***, the two females illustrated differing from ***helianthi*** as follows: apex of spermatheca narrow, not blunt as in ***helianthi***, apical sheath apparently arising close to apex and not enveloping a large part of apex as in ***helianthi;*** spermathecal duct very narrow and greatly convoluted as in ***helianthi***, length estimated to be about 50 to 100 times length of spermatheca (only base of duct shown in figures). Two females, from Sabino Canyon, Arizona, are illustrated showing individual variation. Male genitalia very similar to that of ***helianthi*** except dorsally more slender and with the aedeagus process straighter on sides as in fig. 12.

Records.—Larva, July; adults, May, July, August. Tucson, Arizona (Santa Catalina Mts.).

Hosts.—***Franserica ambrosioides, Gaertneria xanthocarpa.***

Physonota unipunctata (Say)

Cassida unipunctata Say (1824, p. 434).

Larva (fig. 4). Length 9 mm. Prothorax with three lateral spines, mesothorax and metathorax each with two lateral spines; first seven abdominal segments each with a lateral spine. Thoracic and abdominal spines with at least apical halves dark; surface of spine minutely toothed. Nearly all spines slightly posteriorly curved. Caudal fork divergent from base and with each process straight or generally outwardly curved. Head pale, mouthparts and region of eyes darker; legs pale except outer dark margin of apical segment, and apex of penultimate segment; caudal fork black in apical two-thirds to three-fourths.

Pupa (fig. 7).—Length 8 mm. Upper surface of mature pupa generally pale yellow. Pronotum with a pair of median dark spots, and lateral posterior angles dark and slightly roughened. Metanotum and fourth abdominal tergite each with a pair of dark spots. Lateral projections present on first five abdominal segments, the anterior four dark, minutely tuberculate and somewhat directed forward although each is posteriorly curved.

Adult.—Length 7.5 to 10 mm., width 5–7 mm. Color above varying from pale yellow to brownish grey. Pronotum with a distinct median dark spot slightly behind middle. Scutellum usually longer than wide. Elytra nearly uniformly colored but occasionally with faint, irregular, dark markings. Internal sutural margin usually darker than disc of elytron. Venter usually with more dark areas than light. At least anterior margins of abdominal sternites II to V always dark, with posterior and lateral margins, and frequently metacoxal process of abdomen light. Legs light with an incomplete irregular dark band around middle of each femur, and an irregular elongate dark spot on posterior face of each tibia. Metasternal ridge usually rather suddenly declivous behind. Spermatheca of female genitalia (figs. 13 and 13A) constricted before opening of spermathecal gland (sg); shape like a

broad U, entire apex with a sheath; spermathecal duct (sd) about one third width of spermatheca, not greatly convoluted, and estimated to be not more than ten times length of spermatheca. Two females, both from Apple River Canyon State Park, Illinois, are illustrated to show individual variation; spermathecal duct not shown in one female. The spermatheca of this species is more like that of *alutacea* than the other species considered, being distinctly swollen before the opening into the spermathecal duct. Male genitalia very similar to that of *alutacea*, differing notably by the characters of the process on the aedeagus; process (fig. 11) elongate, rounded at apex, and suddenly expanded dorsally and laterally at base; apex of process in lateral view (fig. 11A), curved dorsad.

The adults of this species and *helianthi* are somewhat similar and have not been satisfactorily distinguished previously. *P. unipunctata* has a single distinct pronotal spot while *helianthi* has three. The dorsum of *unipunctata* is of a nearly uniform color, and *helianthi* often has the elytra mottled with cream colored spots. The extreme inner margin of each elytron of *unipunctata*, which appears as a thin horizontal ribbon, is generally darker than the elytra, while in *helianthi* the margin is nearly concolorous with the elytra. The venters of the two species are variable although nearly similarly colored. However, each tibia of *unipunctata* bears a dark spot on its posterior face which is absent in *helianthi*. In *unipunctata* the scutellum is usually longer than wide, and not nearly equilateral as in *helianthi*. The metasternal ridge of *unipunctata* is rather suddenly declivous behind and not nearly evenly rounded as in *helianthi*.

Records.—Larvae, June, July; pupae, July; adults, April to August. Colorado, Illinois, Iowa, Kansas, Manitoba, Minnesota, Missouri, Nebraska, North Dakota, Ontario, Pennsylvania, West Virginia.

Host.—*Monarda*.

Physonota alutacea Boheman

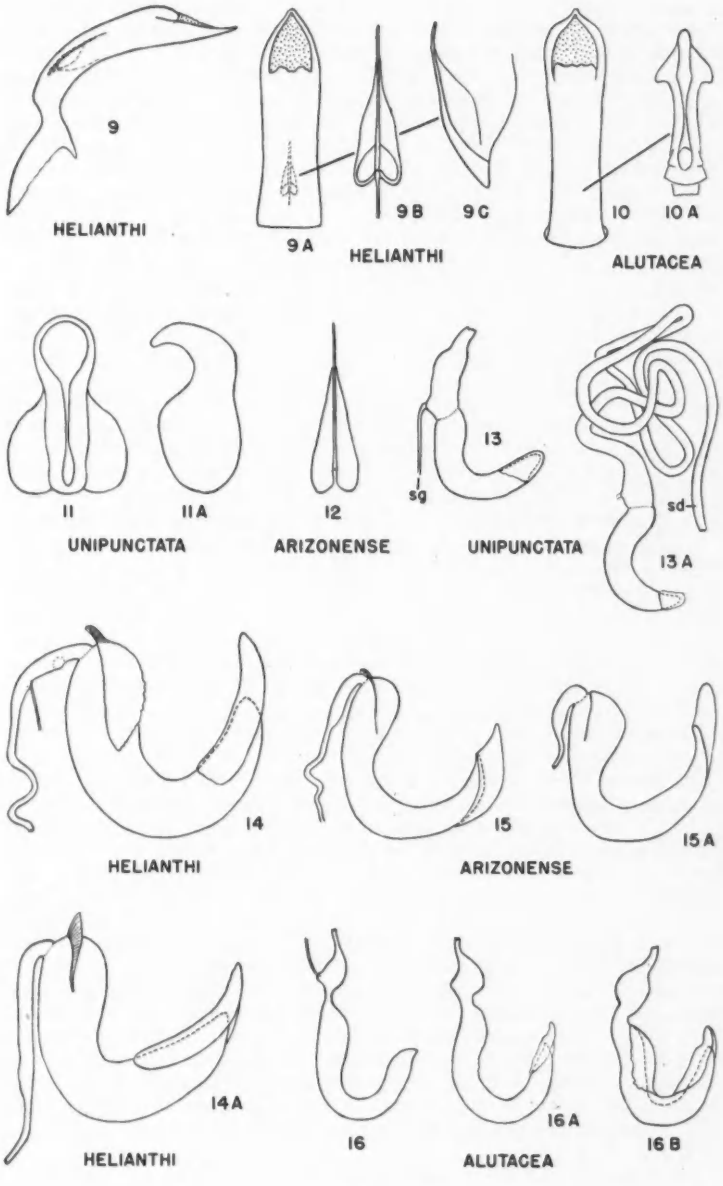
Physonota alutacea Boheman (1854, p. 191)

Larva (fig. 5). Length 11 mm. from head to base of caudal fork. Prothorax with three lateral spines, mesothorax and metathorax each with two lateral spines, and first seven abdominal segments each with a lateral spine. Spines nearly smooth, light in color with extreme apex usually dark; all spines posteriorly curved, and nearly of equal

---

EXPLANATION OF PLATE II

Fig. 9. *Physonota helianthi*. Male genitalia, lateral aspect. 9A—Male genitalia, dorsal view. 9B—Process of aedeagus of male genitalia, dorsal view. 9C—Lateral view. Fig. 10. *Physonota alutacea*. Male genitalia, dorsal view 10A—Process of aedeagus of male genitalia, dorsal view. Fig. 11. *Physonota unipunctata*. Process of aedeagus of male genitalia, dorsal view. 11A—Lateral view. Fig. 12. *Physonota arizonense*. Process of aedeagus of male genitalia, dorsal view. 12A—Lateral view. Fig. 13. *Physonota unipunctata*. Female genitalia, spermetheca (from Illinois). 13A—Spermatheca showing convoluted duct (from Illinois). Fig. 14. *Physonota helianthi*. Female genitalia, spermatheca (from Manitoba). 14A—Same from Illinois. Fig. 15. *Physonota arizonense*. Female genitalia, spermatheca (from Arizona). 15A—Same from Arizona. Fig. 16. *Physonota alutacea*. Female genitalia, spermatheca (from Monterey, Mexico). 16A—Same locality. 16B—Same from Texas.


9
HELIANTHI
9A
9B
9C
HELIANTHI
10
10A
ALUTACEA
11
11A
UNIPUNCTATA
12
ARIZONENSE
13
sg
UNIPUNCTATA
sd
13A
14
HELIANTHI
15
15A
ARIZONENSE
14A
HELIANTHI
16
16A
ALUTACEA
16B

length except the first two prothoracic pair, which are shorter than the other thoracic spines, and the gradually shorter spines toward the caudal fork. Prothorax with almost the entire lateral and anterior margin dark and with two longitudinal dark discal marks. Mesonotum and metanotum and first seven abdominal segments each with a medially interrupted transverse dark band, and a narrow dark band on the sutures between the thoracic and abdominal segments. Caudal fork subequal in length to abdomen, the two processes inwardly curved; color dark brown to deep black toward apex, the surface minutely toothed. Abdominal sternites II to VII transversely banded with dark brown to black; band broadly interrupted with yellow on sternites II, III, and VII. Coxal region and outer margins of legs dark marked. Head pale yellow, area around ocelli dark; labrum and mandibles dark.

Pupa (fig. 8).—Length 11 mm. Upper surface pale yellow except as follows: pronotum with two longitudinal dark marks near middle, a small rounded spot laterad of this, and a transverse band arising near lateral margin and extending mesad; extreme anterior margin dark on either side of apex, and two small dark tubercles or swellings on margin about midway to base. Mesonotum and metanotum each with a median and a lateral dark spot. First five abdominal segments with lateral pointed processes, pale in color except for dark apexes and dark anterior margins of processes of first segment. Processes generally directed forward. Abdomen with transverse dark markings.

Adult (figs. 1 and 2).—Length 12 to 15 mm.; width 7.5 to 11 mm. Color yellowish green to grey. Pronotum with three primary dark areas: a small median dark spot slightly behind middle, and on each side an irregular trilobed spot at base about midway between meson and lateral pronotal margin. Anterior to the median and lateral spots is a shallow U-shaped dark area consisting of many small irregular dots. Elytra rather prominently raised or tumid in basal third. Posterior two-thirds of elytra, behind apex of tumidity, with several small dark spots near suture. Longitudinal impression near lateral margin of elytron occasionally with a few dark punctures. Metasternum on each side of meson suddenly declivous laterally and posteriorly so as to become conspicuously angulate. Legs largely yellow with nearly all of posterior margins of femora and tibiae dark; femur with an irregular dark area on each side extending from dark marginal area. Prosternum and mesosternum mostly yellow; metasternum and abdomen with extensive dark areas, the metasternum lighter on sides and anteriorly. Abdomen with median and a lateral dark area as in fig. 1. Spermatheca of female genitalia (figs. 16, 16A, 16B) with a strong constriction before opening to gland; a distinct swelling beyond constriction leading to a relatively short and convoluted spermathecal duct; duct about as long and approximately of same width as shown for ***unipunctata*** (fig. 13A). Illustrations show variation in spermatheca of females from Monterey, Mexico, and Mercedes, Texas. Apical region of male genitalia in dorsal view (fig. 10) rather suddenly narrowed and emarginate before apex; aedeagus process (fig. 10A) arrowhead shaped but with a long, wide, slightly flaring basal shaft; process nearly straight in lateral view.

This species is unique in our fauna in the type of pronotal maculation,

ventral coloration, and the usually tumid elytra. Of the North American species, its larva is more closely related to ***unipunctata*** by having three lateral spines on the prothorax, and two each on the mesothorax and metathorax.

Records.—Mercedes and Brownsville, Texas. Larvae, April, May, August; pupae, May; adults, May and July.

Host.—*Cordia boissieri.*

UNRECOGNIZED SPECIES

Physonota pacifica Spaeth (1932, p. 198)

This species, described from one specimen from California, E. Donge, 1910, has not been recognized in the material available for study. It was compared with *alutacea* Boh.

Physonota picticollis Boheman (1854, p. 193)

Described originally from Mexico, this species has been recorded as occurring in Arizona. Barber (1916) compared an Arizona example, identified by Schaeffer as *picticollis*, with a Guatemalan specimen of *picticollis* from the Biologia material, stating that they differed in habitus. Subsequently Schaeffer described *P. unipunctata arizonense*, apparently considering that his Arizona species was undescribed.

LITERATURE CITED

Barber, H. S. 1916. A review of North American tortoise beetles. Proc. Ent. Soc. Wash. 18: 113–27.

Boheman, C. H. 1854. Monographia Cassididarum II.

Caulfield, F. B. 1884. Remarks on *Chrysomela scalaris* Lec., *Chrysomela labyrinthica* Lec. and *Physonota unipunctata* Say. Can. Ent. 16: 226–7.

1886. On *Physonota unipunctata* Say and its supposed varieties. Can Ent. 18: 41–5.

1887. Some further notes on *Physonota*. Can Ent. 19: 73–6.

Criddle, N. 1926. A note on the synonymy of certain species of *Physonota*. Can. Ent. 58: 207–8.

Hamilton, John. 1886. Natural History Notes on Coleoptera. Can. Ent. 18: 111–15.

Randall, J. W. 1838. Description of new species of Coleopterous insects inhabiting the state of Maine. Boston Jour. Nat. Hist. 2: 1–33.

Say, T. 1824. Descriptions of Coleopterous insects collected in the late expedition to the Rocky Mountains . . . Jour. Acad. Nat. Sci. Philadelphia, 3: 404–462.

Schaeffer, C. 1925. New species and varieties of North American Cassidini. Jour. New York Ent. Soc. 33: 233–7.

Spaeth, F. 1932. Neue Cassidinen. Stett. Ent. Zeitung 93: 182–204.

Walsh, B. D. 1869a. Insects infesting the sweetpotato. The American Entomologist 1(12): 234–8.

1869b. Tortoise beetles. The American Entomologist 2: 2–5.

POSTSCRIPT ON THE "ODD BEETLE"

H. S. BARBER

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration,

United States Department of Agriculture

Ignotus is a synonym of *Thylodrias*.

In a much appreciated note from A. N. Zhelokhovtsev of the Zoological Museum, Moscow State University, in reply to my recent notes on this pest[1] the original type, a male, of *Thylodrias contractus* Mots., 1839, is said to display nine-jointed antennae conforming fully with my illustration (p. 346, fig. 1A). The antennae are not eleven-jointed as described by Motschulsky and shown in his illustration which was photographically copied as my figure 1C. Other morphological characters of the type coincide with the description by A. P. Semenov, 1912, in the Russian Entomological Review, vol. 12, p. 498. Such errors by old authors may be numerous. Reliance on record of detail may greatly mislead us. Our modern lenses and better standard of preservation of specimens show us structures which were misunderstood by our predecessors with their poor optical equipment and inadequate samples, but our present standards and methods will probably be considered inadequate by our successors.

The synonymy which I indicated at the bottom of page 347 is therefore to be accepted and the alternative synonymy suggested at the top of page 348 rejected. Occurrence of this pest in Montreal has been added to the record by Robert.[2] I should have emphasized the fact that infestations by this species are usually evident from their numerous larval skins. These skins differ greatly from larval exuviae of other small dermestids by showing a single transverse row of almost contiguous curved stiff hairs across each tergite. Even where the species is abundant one rarely finds adults of either sex.

---

[1]Barber, H. S., 1947, Ann. Ent. Soc. Amer., 40: 344–349.

[2]Robert, A., 1947, Nat. Canad., 74: 189–194.

A NEW SPECIES OF MITE, HYPOASPIS MURINUS, FREQUENTLY TAKEN FROM RATTUS SPP.

(Laelaptidae: Hypoaspinae)

R. W. STRANDTMANN

Texas Technological College, Lubbock, Texas

AND

GEORGE C. MENZIES

Bureau of Laboratories, Texas State Department of Health, Austin, Texas

The species of mite here described has been recovered regularly enough in various rat ectoparasite surveys that it has become necessary to have a name for it. We have not been able to find a suitable description in the available literature and are forced to conclude that it is new. It is described below as follows.

Hypoaspis murinus n. sp.

Female.—Pale brownish in color, oval in outline and with faint shoulders; average size about 580 μ long by 360 μ wide. The setae are of moderate length and thickness. The measurements given below are in microns and indicate the average and the two extremes of 10 measurements.

	D L	D W	StL	StW	GVL	GVW	A L	A W	A-GV	F Lg	H Lg	T I
Smallest.....	533	347	111	87	183	112	73	73	20	413	447	12.0
Average.....	581	359	115	93	211	119	86	84	37	465	481	12.5
Largest.....	666	378	125	99	216	133	93	93	80	507	520	13.6

The above symbols are explained as follows: D L, Length of the dorsal plate; D W, Width of the dorsal plate; StL, Length of the sternal plate; StW, Width of the sternal plate at its narrowest point; GvL, Length of the genitoventral plate, measured from the posterior margin of the sternal plate to the tip of the genitoventral plate; GVW, Width of the genitoventral plate at the widest point; A L, Length of the anal plate from the anterior margin to the base of the odd seta; A W, Width of the anal plate; A-GV, Distance between the genitoventral and anal plates; F-Lg, Length of leg I from base of coxa to tip of tarsus exclusive of the claw; H-Lg, Length of leg IV similarly measured; T I, Length of tarsus I, exclusive of the claw.

Venter.—Sternal plate reticulate, longer than wide, the posterior margins extending to the middle of coxa III; with three pairs of setae and two pairs of pores. Presternal area lightly sclerotized and containing a distinct pair of transversely bistriate presternal plates (fig. B). Endopodal plates quite distinct and extending from the posterior lateral angle of the sternal plate to the posterior edge of coxa IV; endopodal seta slightly more slender than the sternal setae. Genitoventral plate drop-shaped, noticeably broadened behind coxa IV, and bearing one pair of setae; posteriorly it extends fairly close to the anal plate (average distance 37 μ); configuration of lines apparently characteristic and essentially as shown in fig. B. Anal plate roundly triangular, the anterior margin strongly arched, the anal pore placed nearer the posterior

than the anterior margin; the three anal setae of equal size, the paired ones placed opposite the middle of the anal pore. A pair of large, roughly elliptical metapodal plates and three pairs of small ones, placed as shown in fig. B. Setae on the non-sclerotized portion of the venter varying in number from 7–10 pairs; the number frequently different on opposite sides of the same individual. Stigma situated opposite the posterior edge of coxa III, the narrow peritreme extending forward to the middle of coxa I. Post-stigmatal sclerotization reaching backward to a point opposite the middle of coxa IV where it is truncate and bears a pore. Tritosternum branching at the apex of the basal segment. Cilia extending from base to apex of each segment, rather long and widely spaced.

Dorsum.—Dorsal plate undivided and normally covering the entire dorsum, but occasional mounts showing a narrow uncovered portion (note dotted line in fig. B); about 36 pairs of setae placed in a definite pattern anteriorly but tending to be irregularly scattered posteriorly. Setae moderately long, rather weak and only barely overlapping each other; subequal throughout, the penultimate pair as long as the last pair,differing in this respect from the laelaptines, in which the penultimate is always shorter. About 10 pairs of pores scattered over the dorsum, including a pair of large slit-like pores at the anterior end (fig. A). A network of fine lines visible over the entire plate. Posterior pair of setae appearing weakly plumose.

Gnathasome (figs. A, C and D).—Corniculi pronounced and strongly pigmented. Lingula (labium) acutely triangular. Hypostome with six rows of minute denticles, each row consisting of approximately 10 teeth. Epistome rather short, convex and with serrated margin (fig. A). Chelicerae prominent (figs. C and D being drawn to the same scale), with the arms of the chela subequal. Digitus mobilis with two teeth well below the incurved apex and with a semi-circle of small setae at its base; digitus fixus with four teeth and a slender, straight, non-inflated pilus dentilis.

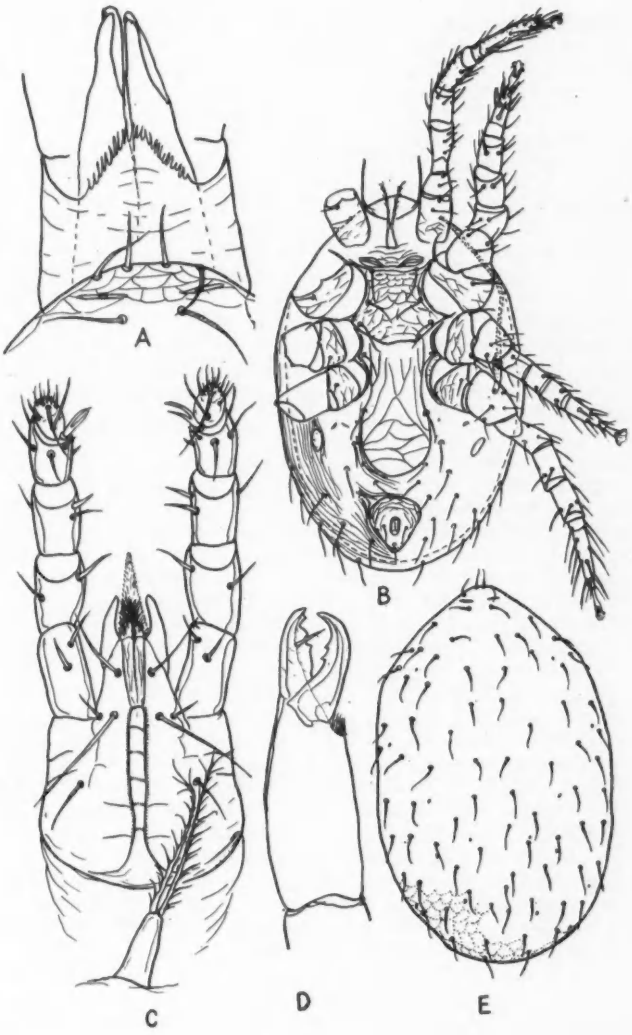
Legs.—Setation as shown in fig. B. Coxae I–III each with two slender setae, coxa IV with one. No spurs or heavy spines, but the apical setae of tarsi II–IV, especially of tarsus II, quite strong; dorsal setae slender and of uniform lengths throughout. All tarsi with claws and pulvillus.

Male.—not known.

Immature forms.—not known.

Types.—described from 35 females of which one was designated holotype and the rest paratypes. The holotype was taken from *Rattus norvegicus*, April 11, 1945, Galveston, Texas, and is deposited in the U. S. National Museum. Paratypes are in the collections of the University of Texas Medical School, the Texas State Health Department, and in the U. S. National Museum.

Hosts and distribution.—CALIFORNIA: Litter from chicken house, Santa Clara County, April, 1937, 3 specimens. FLORIDA: *Rattus norvegicus* (Erxleben), Jacksonville, November, 1947, (M. L. Braswell, collector) 3 specimens. GEORGIA: *Rattus rattus alexandrinus* (Geoffroy), Richmond County, February 8, 1946, 1 female. *Rattus norvegicus* (Erxleben), Colquitt County, March 26, 1946, 1 female. *Field mouse*,



Hypoaspis murinus, female. A. Epistome and anterior portion of dorsum. B. Venter. C. Gnathasome and tritosternum, ventral view. D. Chelicera. E. Dorsal plate.

species undetermined, Grady County, December 27, 1946, 3 slides, 8 specimens. ***Rattus norvegicus*** (Erxleben), Decatur County, January 3, 1947, 1 female. ***Sigmodon h. hispidus*** (Say & Ord), Grady County, April 15, 1947, 1 slide, 2 females. ***Rattus norvegicus*** (Erxleben), Decatur County, June 6, 1947, 1 female. ***Rattus norvegicus*** (Erxleben), Thomas County, July 10, 1947. 1 female. ***Rattus norvegicus*** (Erxleben), Thomas County, October 2, 1947, 1 female. ***Rattus norvegicus*** (Erxleben), Decatur County, October 7, 1947, 1 female. ***Rattus rattus alexandrinus*** (Geoffroy), Grady County, October 23, 1947, 1 female. ***Rattus rattus rattus*** (Linnaeus), Grady County, December 12, 1947, 1 female. MASSACHUSETTS: Water chestnut, Boston, from China, September ,1934, 1 female (O. A. Hardy, collector). NEW YORK: Banana debris, New York, from Panama, 1936 (P. Ortiz, collector). Hyacinth bulbs, New York, from Holland, April 2, 1946 (J. Cochran, collector). TEXAS: ***Rattus norvegicus***, Galveston County, April 11, 1945, 2 specimens. ***Rattus norvegicus***, San Antonio, Bexar County, May 1, 1947 (Mason, collector). ***Rattus alexandrinus***, Lavaca County, April 4, 1947 (Barns, collector). VERMONT: ***Peromyscus maniculatus gracilis***, Morgan, Vermont, September 4, 1932, 4 specimens, 1 slide (Francis Harper, collector).

Remarks.—At first glance, this mite appears similar to ***Atricholaelaps***, but a critical study soon reveals many differentiating features. In this mite, the sternal plate is longer than wide, there are two distinct jugular plates, the tritosternum branches at the apex of the basal portion, the teeth on the hypostome are 8–10 or more per row (3–5 in ***Atricholaelaps***) the epistome is serrated and the pilus dentilis is not inflated.

The genus ***Hypoaspis*** is still poorly understood; we are using it here in the sense that Vitzthun uses it in his 1941 classification.

This species differs from other ***Hypoaspis*** with which we are familiar in having a somewhat longer sternal plate, heavier spines on tarsus II, fewer teeth on the chelae, and noticeably shorter dorsal setae.

It is true that this mite is recovered fairly frequently from rats, yet it is never abundant and whether it is truly parasitic is questionable.

Acknowledgements.—We wish to express our sincere appreciation to personnel of the U. S. Public Health Service for making these slides available to us and permitting us to publish the description. Especially do we appreciate the cooperation of Harvey B. Morlan, S. A. Sanitarian (R) who supplied us with all the Georgia records, and D. C. Thurman, Jr., S. A. Sanitarian (R) for the Florida records. Also we wish to thank Edw. W. Baker for material from the U. S. National Museum and Louis J. Ogden, S. A. Sanitarian, and Ernest Watson for access to material from the typhus survey in Texas.

TEXT REFERENCE

Vitzthum, H. Graf. 1941. Das System der Acari. H. G. Bronns, Klassen und Ordnungen des Tierreichs, Funfter Band, IV Abteilung, 5 Buch. Acarina, Lieferung 5, pp. 751–800.

ON SOME AMERICAN SPIDERS OF THE FAMILY ERIGONIDAE[1]

RALPH V. CHAMBERLIN,
University of Utah,
Salt Lake City

The present paper is necessitated by the large number of new forms that came to light while the writer was undertaking to arrange systematically the extensive collection of Erigonidae accumulated over many years at the University of Utah. To diagnose and name a portion of these new forms at this time seems a desirable step in work on the taxonomic problem presented by this large and difficult family, even though the assignment of some species to their genera must for the present be tentative, more especially where the species are known only from females. This must remain the situation until much work is done by way of establishing or clarifying the too much neglected generic characters presented by the females and of correlating these with those of the males.

The writer is glad to acknowledge here the assistance given by Mr. Wilton Ivie, his former associate at the University of Utah, in the preparation of many of the descriptions and drawings reproduced in this paper.

Genus **Anacornia** Chamberlin and Ivie, 1933

Bull. Univ. Utah, Biol. Ser., 2(2): 29.

Orthotype: *Anacornia microps* Chamberlin and Ivie.

Anacornia microps Chamberlin and Ivie

Figs 1–3

Anacornia microps Chamberlin and Ivie, 1933, Bull. Univ. Utah, Biol. Ser., 2(2): 29; *6: 58–60 and 7: 63–68.

Additional figures of this species are given to facilitate comparison with the next species.

Anacornia proceps new species

Figs. 4, 5

Carapace light brownish yellow. Chelicerae orange brown. Sternum and labium yellowish, lightly shaded with dusky. Endites yellowish to orange. Legs and palpi light yellowish brown. Abdomen light to medium gray. Spinnerets yellowish. Epigynum and male palpus reddish brown.

Head of male elevated forward and projecting over clypeus; a short, blunt horn, bearing numerous short setae, projecting forward from median ocular area. Eye area with many short setae. Eyes small, widely separated; anterior row recurved, a. m. eyes subcontiguous, about three diameters from lateral eyes. Posterior row slightly

[1]Cost of publication paid in part by the Research Committee, University of Utah.

recurved; p. m. eyes about 4 diameters apart, a little more than 2 diameters from the side eyes. Median ocular quadrangle wider behind than long; more than twice as wide behind as in front. Height of clypeus about 5 diameters of a. m. eyes. Chelicerae normal; stridulating file weak; fang groove with five teeth in front, (three or) four behind. Legs normal, sternum pointed behind, separating hind coxae by one diameter or less.

Palpus: Femur and patella normal. Patella a little longer than wide; convex on ventral side; excavated ectally on dorsal side, with a keel-like, two pointed spur on meso-posterior side of depression. Thick patch of long setae on ectal side, their cymbium normal. Paracymbium hooked. Subtigulum and tigulum normal with broad, short bizel. Embolic division with central part bullous with a distal lamella supported by a dark, pointed process; with a flattened, clavate tail-piece; embolus long and looped with a slender lash-like tip, and a pointed process attached at base.

Female.—Head not elevated nor extended forward. Inter-ocular area without numerous short setae. Anterior eye row slightly recurved; a. m. eyes subcontiguous, about 2 diameters from side eyes. Posterior row straight; p. m. eyes about 3 diameters apart, about 2 diameters from side eyes. Median ocular quadrangle wider than long, much wider behind than in front. Epigynum transverse, short (figs. 4, 5).

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	2.15	195	2.70	216
Carapace:				
Length	1.10	100	1.25	100
Width	0.80	73	0.86	69
Tibia-patella:				
1	1.06	96	1.12	90
4	1.12	102	1.27	102

Type locality.—UTAH: vicinity of Mirror Lake, Uintah Mts., Sept. 22, 1932, ♂ holotype, ♀ allotype; July 28, 1936, 3 ♂ paratypes; W. Ivie collector.

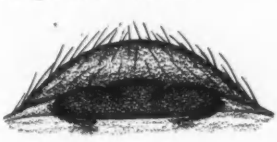
Other records.—UTAH: Provo River at Cobble Rest Camp, Uintah Mts., July 30, 1936, 2 ♂, 2 ♀, W. Ivie; Chalk Cr., Uintah Mts., Aug., 1929, ♂, R. V. Chamberlin.

Genus **Catabrithorax** Chamberlin, 1920

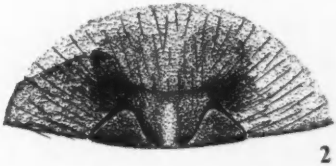
Orthotype: *Catabrithorax clypiellus* Chamberlin.

EXPLANATION OF PLATE I

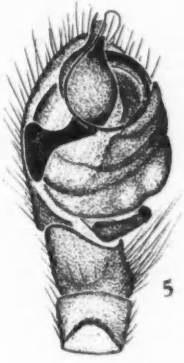
1. *Anacornia microps* Chamberlin and Ivie. Epigynum, caudal view. 2. *Anacornia microps*, n. sp. Epigynum, ventral view. 3. *Anacornia microps* Chamberlin and Ivie. Patella and tibia of ♂ palpus, dorsal view. 4. *Anacornia proceps* n. sp. Patella and tibia of ♂ palpus, dorsal view. 5. *Anacornia proceps* n. sp. ♂ palpus, meso-ventral view. 6. *Catabrithorax* (*Stenosus*) *plumosus* (Emerton). Epigynum, caudal view. 7. *Catabrithorax* (*Stenosus*) *plumosus* (Emerton). Epigynum, ventral view. 8. *Catabrithorax stylifer* n. sp. ♂ palpus, subventral view. 9. *Catabrithorax stylifer* n. sp. ♂ palpus, ectal view. 10. *Catabrithorax stylifer* n. sp. Epigynum. 11. *Catabrithorax stylifer* n. sp. Patella and tibia of ♂ palpus, dorsal view. 12. *Ceraticelus tuganus* n. sp. Patella and tibia of ♂ palpus. 13. *Ceraticelus tuganus* n. sp. Epigynum.



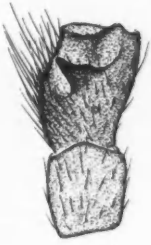
1



2



5



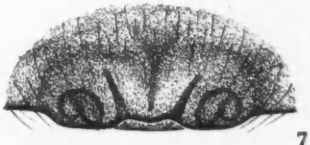
3

4

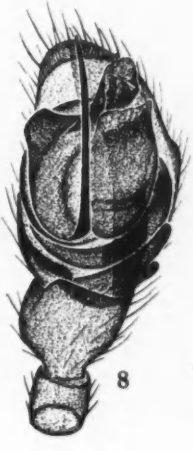
11

12

6

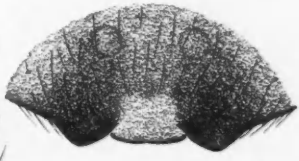


7

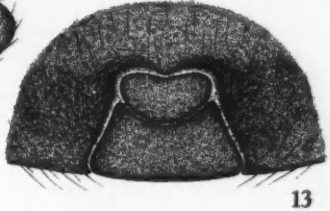


8

9



10



13

Subgenus **Catabrithorax**, sens. str.

Catabrithorax (Catabrithorax) clypiellus Chamberlain

Catabrithorax clypiellus Chamberlin, 1920, Canadian Ent., 52: 199; *1–3.
Catabrithorax ceuthus Chamberlin, 1920, Canadian Ent., 52: 200; *4–5.
Catabrithorax clypiellus Crosby & Bishop, 1928, New York State Mus. Bull. no. 278: 64; *78–80.

Type locality.—UTAH: Logan Canyon, ♂ holotype. (Chamberlin, 1920.) M. C. Z.

Other records.—COLORADO: Berthoud Pass, Aug. 24, 1935, 4 ♂, 4 ♀. IDAHO: Pineview, Aug. 14, 1940, ♂. UTAH: Mirror Lake, Uintah Mts., Aug. 18, 1942, ♂♂, ♀♀, W. Ivie; Fish Lake; Sept. 4, 1929, ♂ ♀, Chamberlin and Gertsch. WYOMING: Bridge Bay, Yellowstone Lake, Aug. 11, 1940, 3♂, 5♀.

Catabrithorax (Catabrithorax) stylifer, new species

Figs. 8–11

Catabrithorax clypiellus Chamberlin and Ivie, 1933, Bull. Univ. Utah. (Not *C. clypiellus* Chamberlin, 1920).
Catabrithorax clypiellus Chamberlin and Ivie, 1947, Bull. Univ. Utah, 10(3): 30.

Male, female.—Color: Carapace light brown, lightly shaded and marked with dusky. Chelicerae and endites light orange brown. Sternum and labium dusky brown. Legs and palpi yellowish brown. Abdomen dark gray. Spinnerets yellowish brown.

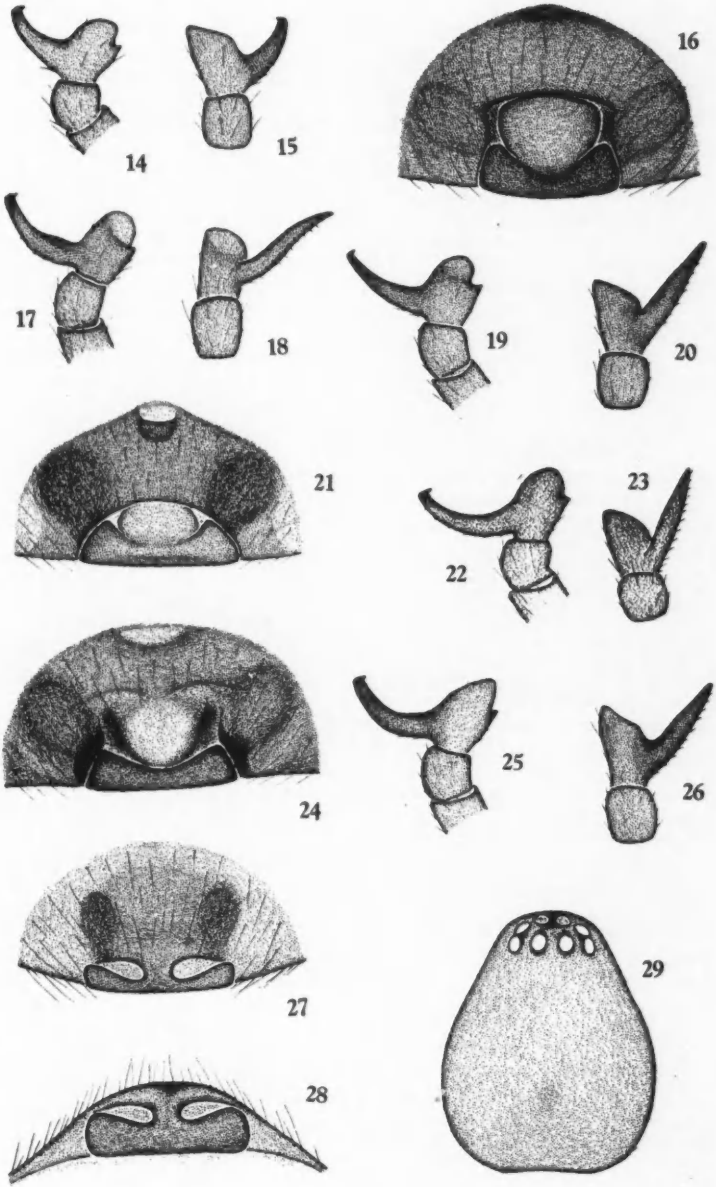
Structure: Essentially normal. Head of male very slightly humped back of the eyes. Height of clypeus 2.5 diameters of an a. m. eye in female, 3.0 diameters in male. Anterior eye row straight; a. m. eyes about 0.3 diameter apart, about the same distance from the larger side eyes. Posterior row straight; eyes equidistant, 0.8 or 0.9 diameter apart. Median ocular quadrangle a little longer than wide, slightly wider behind than in front. Chelicerae vertical, normal; stridulating file present in both sexes; fang groove with five teeth in front, four tiny denticles behind. Structure of the epigynum and palpus shown in the figures.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.73	211	1.82	212
Carapace:				
Length	0.82	100	0.86	100
Width	0.64	78	0.64	74
Tibia-patella:				
1	0.64	78	0.70	81
4	0.73	89	0.82	95

EXPLANATION OF PLATE II

14, 15. *Ceratinella brunnea* Emerton. Patella and tibia of ♂ palpus, two views. 16. *Ceratinella buna*, n. sp. Epigynum. 17, 18. *Ceratinella buna* n. sp. Patella and tibia of ♂ palpus, two views. 19, 20. *Ceratinella diversa* n. sp. Patella and tibia of ♂ palpus, two views. 21. *Ceratinella ornatula alaskana* n. sp. Patella and tibia of ♂ palpus, two views. 22, 23. *Ceratinella placida* Banks. Patella and tibia of ♂ palpus, two views. 24. *Ceratinella tigana* n. sp. Epigynum. 25, 26. *Ceratinella timpibius* n. sp. Patella and tibia of ♂ palpus, two views. 27, 28. *Ceratinops uintana* n. sp. Epigynum, ventral and caudal views. 29. *Ceratinopsis gosibia* n. sp. Cephalothorax, dorsal view.


14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

Type locality.—UTAH: South Fork of Raft River, 8 miles south of Lynn, Sept. 6, 1932, ♂ holotype, ♀ allotype, ♂♂ ♀♀ paratypes (Chamberlin and Ivie); Dove Creek and Clear Creek, 1933, ♂♂ ♀♀ (Chamberlin and Ivie).

Other records.—ALASKA: Homer, July 20–25, 1945, ♀, J. C. Chamberlin. CALIFORNIA: Eureka, July 13, 1937, 4 ♂, 3 ♀, R. V. Chamberlin; Weed, Sept. 7, 1935, ♂, 4♀, Chamberlin and Ivie; Mt. Lassen Park, Sept. 7, 1935, ♂♂ ♀♀, Chamberlin and Ivie; E. side Mammoth Lake, Aug. 9, 1931, ♀, W. Ivie. IDAHO: Lost Lake, Aug. 20, 1936, ♂, 2 ♀, W. Ivie; Lake Forks, July 4, 1943, 3 ♀, W. Ivie. NEVADA: Ruby Valley, Sept., 1937, 3 ♀, R. V. Chamberlin. OREGON: Hillsboro, 1937, ♀, J. C. Chamberlin; Three Rocks, near Otis, May 31, 1942, ♀, J. C. Chamberlin; Newport to Waldport, April 25, 1937, ♂, J. C. Chamberlin; Hauser, May 26, 1937, 2 ♂, ♀♀, J. C. Chamberlin.

This species is very close to *C. clypiellus* Chamberlin, but is distinguishable mainly by the more slender extension from the tail-piece of the embolic division.

Subgenus **Catosus**, new

Orthotype: *Catabrithorax oxypaederotipus* (Crosby).

In the male this subgenus is distinguished by the branched tail-piece of the embolus of the palpus.

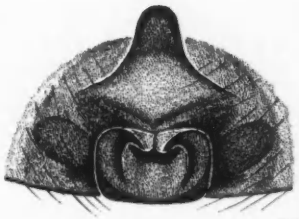
Catabrithorax (Catosus) oxypaederotipus (Crosby)

Oedothorax oxypaederotipus Crosby, 1905, Proc. Acad. Nat. Sci. Phila., 336; *28.9, 15.
Oedothorax oxypaederotipus Petrunkevitch, 1911, Cat. Spid. Amer., 264.
Tmeticus aestivalis Emerton, 1911, Trans. Conn. Acad. Sci., 16: 394; *3: 1–1c.
Tmeticus aestibalis = *Oedothorax oxypaederotipus* Barrows, 1924, Ohio Journ. Sci., 24: 312.
Catabrithorax oxypaederotipus Crosby & Bishop, 1928, N. Y. State Mus. Bull., no. 278: 66; *91–93.

Records.—MASSACHUSETTS: Holden, June, ♂ ♀, (Emerton, 1911, cotypes of *Tmeticus aestivalis* Emerton); Mt. Toby, June, ♂ ♀, (Emerton, 1911; cotypes of *T. aestivalis*). NEW YORK: Old Forge, Oct. 24, 1922, ♀, C. R. Crosby (Cr. & Bishop, 1928); Meredith, May 19, 1923, 5 ♂ ♀, (Crosby & Bishop, 1928); Slide Mt., May 8, 1921, 2 ♂, 5 ♀, (Crosby & Bishop, 1928); Paradise, Orange Co., May 26, 1920, ♀, (Crosby & Bishop, 1928); Oakland Valley, May 26, 1920, ♂, ♀ (Crosby & Bishop, 1928); Belden Hill, Broome Co., May 19, 1923, ♂♂, ♀♀ (Crosby & Bishop, 1928); Ithaca, February-July, ♂♂, ♀♀, (Crosby, 1905 types), various dates (Crosby & Bishop, 1928); "Cuyahoga," Yakes Co., June 24, 1923, 14 ♀, (Crosby & Bishop, 1928); Letchworth Park, Wyoming Co., July 9, 1922, ♂, 2 ♀, (Crosby & Bishop, 1928);

EXPLANATION OF PLATE III

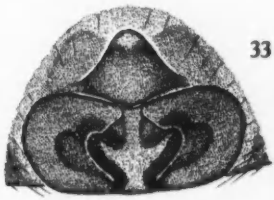
30. *Ceratinopsis gosibia* n. sp. Epigynum. 31. *Ceratinopsis gosibia* n. sp. Patella and tibia of ♂ palpus. 32. *Ceratinopsis gosibia* n. sp. Embolus of ♂ palpus, ventral view. 33. *Ceratinopsis watsinga* n. sp. Epigynum. 34. *Ceratinopsis interventa* n. sp. Epigynum. 35. *Ceratinopsis secuta* n. sp. Epigynum. 36. *Ceratinopsis eutypa* n. sp. Epigynum. 37. *Ceratinopsis (?) oregonicola* n. sp. Epigynum. 38. *Ceratinopsis crosbyi* n. sp. Epigynum. 39. *Ceratinopsis palomara* n. sp. Epigynum, ventral view. 40. *Ceratinopsis palomara* n. sp. Epigynum, caudal view.



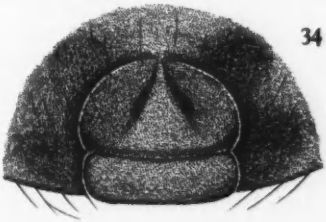
30

31

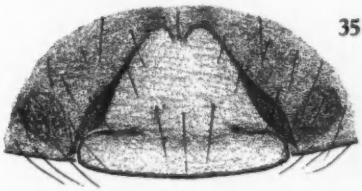
32



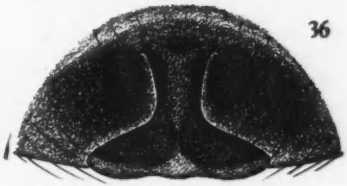
33



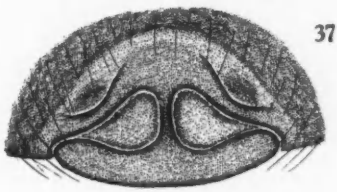
34



35

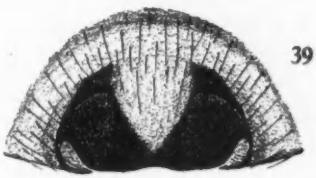


36

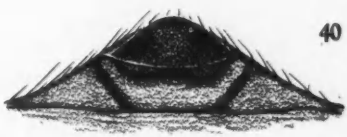


37

38



39



40

Little Valley, etc., 1925, 3 ♀, (Crosby & Bishop, 1928); Penn Yan, May 30, 1923, 14 ♂, (Crosby & Bishop, 1928), etc. OHIO: Rockbridge, May 4, 1918, ♂, W. M. Barrows (Barrows, 1924); Flint, April 28, 1918, ♂, W. M. Barrows (Barrows, 1924). PENNSYLVANIA: President, July 3, 1922, ♀, Palmer (Crosby & Bishop, 1928); Potters Mills, October 31, 1924, ♀, (Crosby and Bishop, 1928).

Subgenus **Stenosus** new

Orthotype: *Stenosus plumosus* (Emerton).

In this subgenus the tail-piece of the ambolus of the male palpus is simple and hairy or plumose instead of bearing spines or scales as in *perplexus*, etc.

Catabrithorax (Stenosus) plumosus (Emerton)

Figs. 6, 7

Tmeticus plumosus Emerton, 1882, Trans. Conn. Acad. Sci., 6: 53; *15: 3.
Tmeticus obscurus Banks, 1892, Proc. Acad. Nat. Sci. Phila., 38; *4: 14, 14a.
Tmeticus humilis Banks, 1892, Ibid. 38; *4: 18.
Gongylidium plumosus Simon, 1884, Arachnides de France, 5: 500.
Oedothorax plumosus Crosby, 1905, Proc. Acad. Sci., Phila., 312.
Oedothorax plumosus Petrunkevitch, 1911, Cat. Spid. Amer., 265.
Oedothorax humilis Petrunkevitch, 1911, Ibid., 262.
Oedothorax obscurus Petrunkevitch, 1911, Ibid., 264.
Tmeticus (Gonglydium) plumosus Banks, 1916, Proc. Acad. Sci. Phila., 74.
Gongylidium plumosus Emerton, 1920, Trans. Royal Can. Inst., 12: 316.
Gongylidium plumosus Emerton, 1924.
Tmeticus plumosus Barrows, 1924.
Catabrithorax plumosus Crosby & Bishop, 1928, N. Y. State Mus. Bull., no. 278; 70; *97–101 (not 100).
Oedothorax plumosus Kurata, 1937, Canadian Field-Nat., 51: 114.

Type localities.—CANADA: Montreal. MASSACHUSETTS: Beverly. NEW HAMPSHIRE: Mt. Washington.

Other records.—CONNECTICUT: Mantic, May 15, 1921, ♂, J. H. Emerton, (Crosby & Bishop, 1928); Norwalk, July 2, 1933, ♀, Wilton Ivie. IDAHO: Mesa, July 2, 1943, ♀, W. Ivie. ILLINOIS: Willow Springs, July 1, 1941, ♀ Henry Dybas; Salts, Aug. 26, 1926, ♂, Smith, (Crosby & Bishop, 1928). MASSACHUSETTS: Beverly, ♀ ♀, (Emerton, 1882, cotypes); Winthrop Beach, Nov. 12, 1922, 3 ♂, ♀, (Crosby & Bishop, 1928); Cambridge, Nov. 17, 1922, ♂, (Crosby & Bishop, 1928); Duxbury, June 4, 1921, ♂, E. B. Bryant, (Crosby & Bishop, 1928). MINNESOTA: Waskish, June 15, 1945, 2 ♀; 8 mi. S.E. Warren, June 12, 1945, ♂♂, ♀ ♀, W. Ivie. NEBRASKA: 10 mi. W. Grand Island, June 6, 1933, ♂, W. Ivie. NEW HAMPSHIRE: Mt. Washington, ♂♂, (Emerton, 1882, paratypes); Mt. Washington, Sept., 1907, ♂, E. B. Bryant, (Crosby & Bishop, 1928); Franconia, ♂, Nathan Banks, (Crosby & Bishop, 1928); Hollis, Aug. (M), 2 ♂, ♀, Wm. Fox, Aug. 4, 1911, E. B. Bryant, (Crosby & Bishop, 1928). NEW YORK: Kingston, March 12, 1919, ♂♂, ♀ ♀, C. R. Crosby, (Crosby & Bishop, 1928, Ms.); Constabeville, Aug. 19, 1927, ♂, P. Needham, (Crosby & Bishop, 1928); Inlet Marsh, Nov., 1888 or 1889, ♂, N. Banks, (Banks, 1892, holotype of *Tmeticus humilis* Banks); Six Mile Cr., 1888–1889, ♂, N. Banks, (Banks, 1892, holotype of *Tmeticus obscurus* Banks); Ithaca, March, 1910, March 17, 1912, July 17, 1920, 3 ♂, C. R. Crosby, (Crosby & Bishop, 1928). NOVA SCOTIA: Barrington, Summer, 1923, E. B. Bryant, (Em.,

1924). OHIO: Columbus, May 2, 1918, ♂, W. M. Barrows, (Barrows, 1924). ONTARIO: Mer Bleue, 10 mi. E. Ottawa, June 2–3, 1931, T. B. Kurata (Kurata, 1937); Algonquin Park, June-July, 1945, ♂, 2 ♂, T. B. Kurata; Port Credit, June 23, 1945, ♀, Stanley Harrod. OREGON: 2 mi. No. Ashland, Sept. 9, 1935, ♂, Chamberlin & Ivie. QUEBEC: Montreal, ♂♂, (Emerton, 1882, cotypes); Lake Megantic, (Emerton, 1920). UTAH: Moab, June 19, 1934, ♂, 3 ♀, W. Ivie & H. A. Rasmussen; Price, June 16, 1940, 4 ♀; Fish Lake, Aug., 1934, ♂. WYOMING: 20 Mi. So. Jackson, June 24, 1938, ♂♂ ♀♀.

Genus **Ceraticelus** Simon, 1884

Arachnides de France, 5: 595.

Generotype: *Ceraticelus fissiceps* (Cambridge).

Ceraticelus agathus, new species

Fig. 157

Female.—Color: Carapace light brown, with eye area black, and with a diffused dusky median line extending back to the median furrow. Chelicerae and endites orange. Sternum and labium yellowish shaded with dusky. Legs and palpi light yellowish brown, with the hind tibia a little darker than the rest. Abdomen light yellowish gray, with sclerites bright orange brown. Spinnerets light brown, surrounded with a light dusky shading.

Structure: Carapace essentially normal, median groove obscure. Clypeus nearly vertical; about 2.5 diam. of a. s. eye in height. Eyes moderately large; the a. m. eyes much smaller than the others. Eye area occupying nearly the full width of the head. Anterior eye row slightly procurved; a. m. eyes 0.9 diameter apart, 1.0 diameter from side eyes. Posterior row faintly recurved; p. m. eyes 0.7 diameter apart, same distance from the slightly smaller side eyes. Median ocular quadrangle about as wide as long, wider behind than in front. Chelicerae normal. Sternum large; broad hind tip separating hind coxae by a length. Legs and palpi normal. Abdomen rounded; with an oval dorsal sclerite which is half the width and two-thirds the length of the abdomen; with a lunate sclerite below and largely surrounding the spinnerets; with a sclerite surrounding the petiole and extending back to include the epigynum, and with lateral epigastric sclerites, separated from the last by a narrow line.

Measurements:

	♀ Holotype	
	Mm.	*Ratio*
Length	1.30	236
Carapace:		
Length	0.55	100
Width	0.44	80
Tibia-patella:		
1	0.40	73
4	0.44	80

Ceraticelus subniger, new species

Figs. 44, 45

Color: Carapace slightly dusky over a background of light brown, with a network of black lines in front of the median stria with three lines

running forward on the head. Chelicerae and endites yellow. Labium yellow with a black cross mark. Sternum dusky or nearly black. The legs light yellow, with the coxae having a black line across distal end and some a longitudinal ventral line. Abdomen blackish throughout excepting the area immediately surrounding the epigynum and the corresponding part of the male.

Structure: The cephalothorax normal, the head in the male moderately roundly elevated behind the eye area. Clypeus about four times the diameter of an a. s. eye. Posterior row of eyes procurved, the median eyes considerably farther from the side eyes than from each other. Anterior row of eyes slightly procurved; the median eyes small about their radius apart but widely separated from the laterals. Quadrangle of median eyes decidedly wider behind than in front. Fang groove of chelicera with five teeth on anterior margin and one on posterior.

The epigynum is of the same general type as that of *formosus* as shown in fig. 44. The apophysis of the male palpus is as shown in fig. 45.

Type locality.—UTAH: 10 miles W. of Salt Lake City; ♂ holotype and ♀ allotype taken Oct. 14, 1939.

Superficially distinguishable from *formosus* in the black color of the dorsal abdominal sclerite of the male.

Ceraticelus formosus pistus, new species

Fig. 46

Close in coloration and general structure to *formosus* but presenting minor but apparently distinct differences, especially in the epigynum and the male palpus. In the epigynum the median area flares out more strongly caudad, with other features as shown in fig. 46. The tibial apophysis of the male palpus as in *formosus* but distally less abrutply curved.

Type locality.—WYOMING: 4 mi. N. of "Old Faithful," Yellowstone Park; ♂ holotype and ♀ allotype taken June 17, 1938.

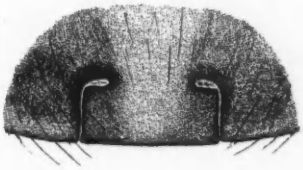
Ceraticelus laetabilis pisga, new subspecies

Fig. 47

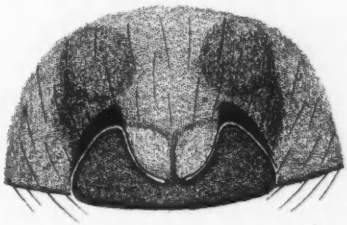
Examination of a considerable number of specimens from Mt. Pisgah, North Carolina, shows certain obvious differences, especially in the epigynum, to be apparently constant. The characteristic form of the epigynum is as shown in fig. 44. See also Crosby & Bishop, Studies in New York Spiders, 1925, plate 5, fig. 51.

EXPLANATION OF PLATE IV

41. *Spirembolus oreinoides* n. sp. 42. *Disembolus zygethus* n. sp. 43. *Disembolus zygethus* n. sp. 44. *Ceraticelus subniger* n. sp. Epigynum. 45. *Ceraticelus subniger* n. sp. Patella and tibia of ♂ palpus, dorsomesal view. 46. *Ceraticelus formosus pistus* n. subsp. Epigynum. 47. *Ceraticelus laetabilis pisga* n. subsp. Epigynum. 48. *Coloncus siou* n. sp. Epigynum, ventral view. 49. *Coloncus siou* n. sp. Epigynum, caudal view. 50. *Coloncus ocala* n. sp. Epigynum, ventral view.

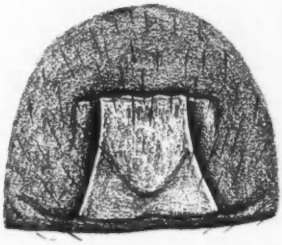


41

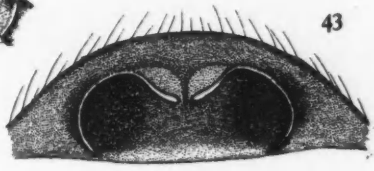


42

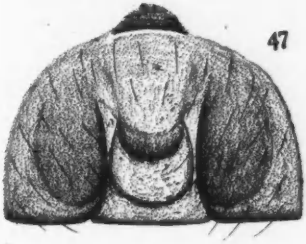
45



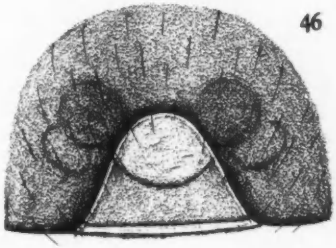
44



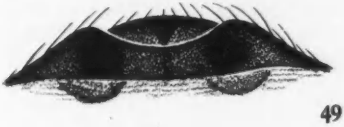
43



47

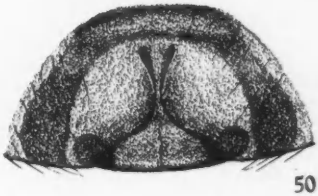


46



49

48



50

All the typical specimens are lighter in color than most specimens of *lateobilis*, although this feature is subject to much variation.

Type locality.—NORTH CAROLINA: Mt. Pisgah, other data lacking; ♂♂ and ♀♀.

Ceraticelus tuganus, new species

Figs. 12, 13

Male, female.—Color: Carapace dark brown, marked with dusky. Chelicerae and endites brown, with lighter tips. Sternum and labium dark dusky brown. Legs and palpi brownish yellow, shaded at the joints; male palpus with tibia and tarsus dark brown. Abdomen nearly black on the soft parts, with sclerites reddish brown shaded with dusky. Spinnerets dusky brown. Epigynum mostly dark dusky brown.

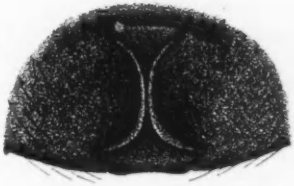
Structure: Size medium. Male carapace broadly avoid, wide behind, narrow in front; clypeus slightly protruding; head slightly humped back of the eyes. Height of clypeus about 5 diameters of an a. s. eye. Eye area occupies 0.7 to 0.8 width of head; eyes small. Posterior eye row slightly procurved; p. m. eye about 1.6 diameters apart, 2.0 diameters from side eye. Anterior row faintly procurved. A. m. eyes 0.8 diameter apart, 1.6 diameters from side eye. Median ocular quadrangle about as wide as long, a little wider behind. Chelicerae vertical; fang groove with four teeth in front, three small teeth behind; stridulating file apparently absent. Sternum as wide as long; intercoxal angles distinct, truncate behind; hind coxae separated by a little more than a diameter. Abdomen somewhat elongate; dorsal sclerite rugose, with four large muscle impressions, equal to width at anterior end, covering anterior end and extending back for three-fourths of length. Epigastric plates distinct, area between sclerotized; a thin sclerite in front of spinnerets below. Palpus not significantly different from that of *rugosus*.

Female.—Carapace essentially normal; head larger than in male, slightly humped back of eyes. Clypeus slightly protruding; height 3.0 to 3.5 diameters of a. s. eye. Eye area occupies 0.7 width of head. Posterior eye row procurved; p. m. eyes about 1.0 diameter apart, 1.2 diameters from side eye. Anterior row faintly procurved; a. m. eye about 0.5 diameter apart, 1.2 diameters from side eye. Median ocular quadrangle about as long as wide, wider behind. Chelicerae vertical without stridulating file (pick absent from palpus); fang groove with four large teeth in front, one or two small teeth behind. Endites, labium and sternum normal; hind coxae separated by slightly more than a diameter. Palpi slender, small. Legs normal. Abdomen large, broadly oval, somewhat depressed; with rugose sclerite in front,

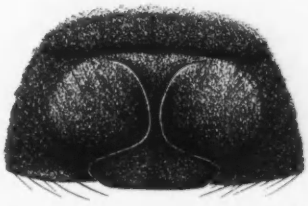
---

EXPLANATION OF PLATE V

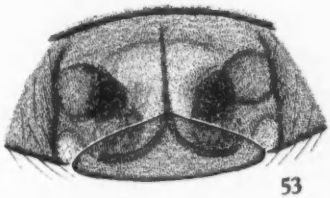
51. *Coloncus americanus* (Chamberlin and Ivie). Epigynum. 52. *Coloncus pius* new species. 53. *Cornicularia selma* new species. Epigynum. 54. *Cochlembolus provo*, new species. Epigynum. 55. *Eularia selma* new species. Epigynum, ventral view. 56. *Eularia selma* new species. Epigynum, caudal view. 57. *Eularia quaestio* new species. Epigynum, ventral view. 58. *Eularia quaestio* new species. Epigynum, dorsal view. 59. *Eularia kaiba* new species. Epigynum, ventral view. 60. *Eularia kaiba* new species. Epigynum, caudal view.



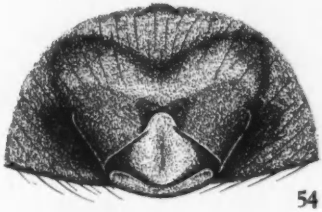
51



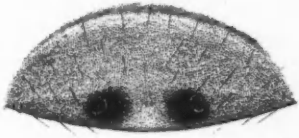
52



53



54



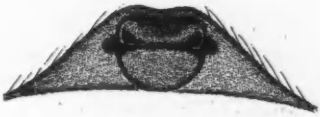
55

57

56

58

59



60

four chitinous dots on top, and a small thin sclerite in front of the spinnerets. Epigynum small; consists of a depression which is wider behind than in front, quadrangular; contains a large transverse piece, concave across front; this is closely joined to a transverse, kidney-shaped middle lobe, which is distinctly separated from the anterior rim.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.80	220	2.06	229
Carapace:				
Length	0.82	100	0.90	100
Width	0.70	85	0.75	83
Tibia-patella:				
1	0.66	80	0.72	80
4	0.72	88	0.81	90

Type locality.—UTAH: 10 mi. W. of Salt Lake City, October 14, 1939, ♂ ♀, same, May, 1938.

The male of this species is similar to *rugosus* but is darker in color with the dorsal sclerite more roughened and the embolus thicker at base.

The female more resembles *formosus;* but is darker in color and the epigynum is proportionately wider in front.

Genus **Ceratinella** Emerton, 1882

Trans. Conn. Acad. Sci., 6: 32.

Generotype: *Ceratinella breve* (Wider).

Ceratinella buna, new species

Figs. 16–18

Male, female.—Color: Carapace dark brown; eyes on black spots. Chelicerae and endites light brown, lighter at distal end. Sternum and labium dusky brown, darker on the border. Legs and palpi light brownish orange, tibia and tarsus of male palpus darker brown. Abdomen with dorsal sclerite reddish brown, shaded around the border to a dark dusky at the edge, and with four dark spots near the center; sides and venter dark grey; ventral sclerites reddish brown. Spinnerets light brown. Epigynum reddish brown to dusky.

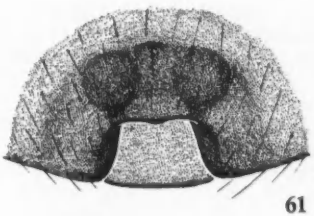
Structure: Size medium to small; typical for the genus.

Male.—Carapace short and wide, rounded; head short, not elevated. Clypeus slightly inclined; height about 2.0 diameters of a. s. eye. Eye area occupies more than 0.7 width of head; eyes small, a. m. eye a little smaller than the others. Posterior eye row slightly procurved; p. m. eyes about 1.1 diameters apart, same distance from side eye. Anterior row straight; a. m. eyes about 0.6 diameter apart, about 0.8 diameter

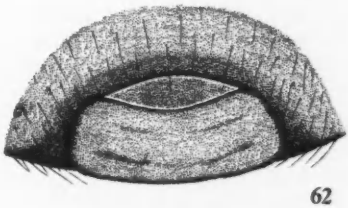
---

EXPLANATION OF PLATE VI

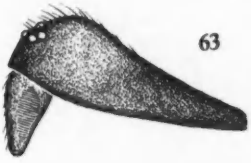
61. *Grammonota salicola* new species. Epigynum. 62. *Gnathantes fusca* Chamberlin and Ivie. Epigynum. 63. *Hilaria garrina* new species. Cephalothorax of ♂, lateral view. 64. *Hilaria garrina* new species. Epigynum, ventral view. 65. *Hilaria garrina* new species. Epigynum, ventral view. 66, 67. *Hilaria garrina* new species. Male palpus, two views. 68. *Hilaria garrina* new species. Patella and tibia of ♂ palpus. 69. *Montilaira relicta* new species. Epigynum, ventral view. 70. *Montilaira relicta* new species. Epigynum, caudal view.



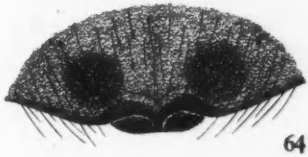
61



62



63

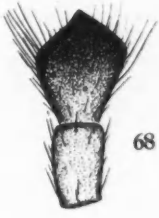


64

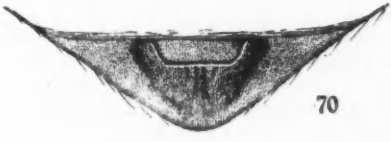
65

67

66



68



70

69

from side eye. Median ocular quadrangle about as wide as long, wider behind. Palpus similar to that of ***brunnea*** and ***placida***, with differences in the spur on the tibia; palpal organs similar. The spur on the tibia has a slight double curve when seen from dorsal view, that of ***placida*** is straight.

Male, female.—Chelicerae small, vertical; fang with usual double curve. Sternum large; separates hind coxae by about 1.5 diameters. Abdomen moderately large; entire dorsum of both sexes, except posterior tip, covered with a moderately convex sclerite. A large sclerite in front of spinnerets below; another sclerite at each end of genital furrow, which is fused with the epigastric plates.

Female.—Carapace not quite as wide as in the male; head slightly humped back of the eyes. Eyes similar to those of male. Epigynum as in ***brunnea***, etc.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.45	223	1.65	220
Carapace:				
Length	0.65	100	0.75	100
Width	0.62	95	0.65	87
Tibia-patella:				
1	0.60	92	0.57	76
4	0.60	92	0.65	87

Type locality.—IOWA: 1935, Floyd Andre, 2 ♂ ♀.

Other records.—IOWA: Benton Co., 1935, F. Andre, ♀; Davis Co., 1935, F. Andre, ♀; Union Co., 1935, F. Andre, ♀. (Dorsal sclerite a little smaller than usual.)

Ceratinella diversa, new species

Figs. 19, 20

Male, female.—Color: Carapace dark brown, more or less marked with dusky. Chelicerae and endites light brown, marked with dusky. Sternum and labium dark dusky brown. Legs and palpi orange brown, more or less shaded at the joints; male palpus brown. Abdomen with dorsal sclerite reddish brown, shaded with dusky around the border, with or without four dark dots near center; sides and venter dark purplish gray; ventral sclerites light reddish brown. Epigynum light reddish brown to dusky brown. Spinnerets light brown.

Structure: Size medium to small.

Male.—Carapace broadly ovoid. Clypeus vertical; height about 2.5 diameters of a. s. eye. Eye area occupies about 0.7 width of head; a. m. eyes decidedly smaller than the others. P. m. eye about 1.1 diameters apart, 1.0 diameter from side eye. Anterior row straight; a. m. eye 0.5 diameter apart, 0.8 diameter from side eye. Median ocular quadrangle a little longer than wide, wider behind. Chelicerae, sternum and abdomen typical. Palpus typical, with tibial spur moderately long, straighter than in ***placida***.

Female.—Carapace moderately broad; head moderately wide, head slightly convex back of eyes. Clypeus vertical; height 2.5 diameters of a. s. eye. Eye area occupies about 0.7 width of head, a. m. eye smaller than the others. Posterior eye row slightly procurved; p. m. eye about 1.8 diameters apart, 1.2 diameters from side eye. Anterior

row straight; a. m. eye about 0.6 diameter apart, 0.7 diameter from side eye. Median ocular quadrangle slightly longer than wide; wider behind. Dorsal sclerite of abdomen large and flat, nearly round, covers most of dorsal surface. Epigynum similar to that of ***brunnea***, etc.

Type locality.—MINNESOTA: 8 mi. S. E. Warren, June 12, 1945, ♂ 2 ♀.

Ceratinella brunnea Emerton

Figs. 14, 15

Ceratinella brunnea Emerton, 1882, Trans. Conn. Acad. Sci., 6: 36; *8: 3.

Male, female.—Color: Carapace dark brown; eyes on black spots. Chelicerae and endites light brown, with pale tips. Sternum and labium dusky brown. Legs and palpi bright yellow, distal part of male palpus darker, brown. Abdomen with dorsal sclerite bright reddish brown at the center, broadly dusky around the margins, with four dark dots near the center (two of these may be indistinct at times); sides dark gray; venter usually a little lighter gray, separated from the side area by a row of pale dots; ventral sclerites light reddish brown. Spinnerets pale brown. Epigynum light reddish brown to dusky brown.

Structure: Size medium to small. Carapace short, broad, and rounded in the male, more nearly normal in the female. Clypeus vertical; height about 2.5 diameters of a. s. eye. Eye area occupies about 0.7 width of head; a. m. eye decidedly smaller than the others, somewhat conical. Posterior eye row very slightly procurved; p. m. eye about 1.0 diameter apart, about 1.0 diameter from side eye (sometimes 0.9 diameter apart). Anterior row straight; a. m. eye 0.3 diameter apart, 0.8 diameter from side eye. Median ocular quadrangle about as long as wide, wider behind.

Chelicerae vertical; fang with distinct double curve; fang groove without teeth on the margins. Sternum large four broad; truncate posterior end separates hind coxae by about 1.5 diameters. Abdomen of male with large dorsal sclerite covering almost entire dorsal surface, extending downward on the sides anteriorly. Epigastric sclerites broadly joined together across the middle, contains a distinct oval opening; with a large lunate sclerite in front of spinnerets. Abdomen of female with dorsal sclerite covering about three-fourths of each dimension and more flat than in the male; sclerite in front of spinnerets similar to male. Epigynum not significantly different from that of *C. buna*. Palpus typical; the spur on the tibia of medium length.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.45	223	1.55	235
Carapace:				
Length	0.65	100	0.66	100
Width	0.60	92	0.57	86
Tibia-patella:				
1	0.54	83	0.50	76
4	0.56	76	0.60	91

Type locality.—NEW ENGLAND: Mt. Washington; cotypes from Salem, Saugus and New Haven.

Other records.—NEW YORK: Enfield Glen, ♂ ♀. QUEBEC: Montreal, October 16, 1923, 2 ♀, Crosby and Bishop. NORTH DAKOTA: Grand Forks, Sept., 1936, ♂, Joe Davis.

Ceratinella hemetha, new species

Ceratinella placida Crosby & Bishop, 1925 (in part), Bull. N. Y. State Museum, no. 264: 9*.

Ceratinella brunnea Chamberlin & Ivie, 1944, Bull. Univ. Utah, Biol. Ser., 8: 63.

Female.—Color: Carapace dark brown; eyes joined with black. Chelicerae and endites brighter, with pale tips. Sternum and labium dusky brown. Legs and palpi bright orange yellow. Abdomen with soft parts dark gray; dorsal sclerite moderately dark reddish brown; ventral sclerites reddish brown; epigynum shaded with dusky. Spinnerets light brown.

Structure: Size medium to small. Carapace essentially typical, with head narrower than usual. Clypeus vertical; height about 1.6 diameters of a. s. eye. Eye area occupies nearly the full width of the head; a. m. eye large, about as large as the others. Posterior eye row faintly procurved; p. m. eyes about 0.9 diameter apart, 0.6 diameter from side eyes. Anterior row straight; a. m. eye about 0.3 diameter apart, 0.2 diameter from side eye. Median ocular quadrangle about as long as wide, a little wider behind. Chelicerae slightly inclined; fang with usual double curve. Sternum and legs typical. Dorsal shield of abdomen large, covering nearly entire dorsal surface; ventral sclerites typical; abdomen covered with unusually long hair. Epigynum not significantly different from that of *brunnea*.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.50	227
Carapace:		
Length	0.66	100
Width	0.57	86
Tibia-patella:		
1	0.50	75
4	0.58	88

Type locality.—GEORGIA: 4 mi. N. E. Sylvania, April 9, 1943, ♀.

Other records.—FLORIDA: Gainesville, February 10, 1942, ♀; W side L. Newman, February 14, 1942.

This species closely resembles *holocerea* in color, size, and general structure. It differs chiefly in having the head narrower, the eyes larger, with the a. m. eye about as large as the others; the abdomen is covered with much longer hairs.

This is evidently the species which Crosby and Bishop (1925) redescribed as *placida*.

Ceratinella holocerea, new species

Female.—Color: Carapace brown, with faint radial streaks; eyes ringed with black, but interocular area not black. Chelicerae light reddish brown. Endites orange brown with pale tips. Sternum and labium dusky brown. Legs and palpi uniform yellowish. Abdomen dark gray on the soft parts; dorsal sclerite reddish brown, with four dusky dots and with margins dusky; ventral sclerites light reddish brown. Spinnerets light brownish.

Structure: Carapace normal for the genus; median groove absent; height of clypeus about 1.6 diameters of an a. s. eye. Anterior median eyes much smaller than the others. Anterior eye row faintly procurved;

a. m. eyes about 0.5 diameter apart, about 0.7 diameter from side eyes. Posterior row slightly procurved; p. m. eyes about 1.0 diameter apart, 0.9 diameter from side eyes. Chelicerae normal; fang with usual double curve. Sternum large and wide; hind coxae separated by about a length. Abdomen flattened; entire dorsum covered by a large, flat sclerite; a broad sclerite in front of the spinnerets. Epigynum not noticeably different from that of ***brunnea***.

Measurements:

	♀ Holotype	
	Mm.	*Ratio*
Length	1.55	235
Carapace:		
Length	0.66	100
Width	0.60	91
Tibia-patella:		
1	0.53	80
4	0.62	94

Type locality.—FLORIDA: Cocoa, Feb. 23, 1925, W. M. Barrows collector, ♀ holotype. In University of Utah collection.

Differs from ***brunnea*** mainly in the larger dorsal sclerite on the abdomen, which is more flat than in ***brunnea***.

Ceratinella kenaba, new species

Female.—Color: Carapace brown. Chelicerae brown, lighter distally and mesally. Endites brown, with whitish tips. Sternum and labium dusky over yellowish brown. Legs and palpi light brown, with joints lighter. Abdomen with soft parts dark gray, sclerites orange brown. Spinnerets light brown.

Structure: Similar to ***brunnea***, except the head is larger and more pronounced. Clypeus vertical; height about 2.0 diameters of a. s. eye. Eye area occupies 0.8 width of head; a. m. eye smaller than the others. Posterior eye row faintly procurved; p. m. eye about 0.9 diameter apart, 0.7 diameter from side eye. Anterior row straight; a. m. eye a little less than 0.3 diameter apart, 0.6 diameter from side eyes. Median ocular quadrangle slightly longer than wide. Epigynum not significantly different from that of ***brunnea***.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.78	254
Carapace:		
Length	0.70	100
Width	0.61	87
Tibia-patella:		
1	0.56	80
4	0.67	96

Type locality.—FLORIDA: Hastings, ♀.

Ceratinella ornatula alaskana, new variety

Fig. 21

Ceratinella ornatula, Chamberlin and Ivie, 1947, Bull. Univ. Utah, Biol. ser., 10 (3): 31.

Female.—Color: Carapace dusky brown; eye area blackish. Chelicerae and endites light brownish, lighter at the tips. Sternum and labium dark dusky brown. Legs and palpi orange. Abdomen with

dorsal sclerite dark dusky brown; sides and venter dark gray, dotted with light gray; ventral sclerites reddish brown. Spinnerets light brown. Epigynum reddish brown and dusky.

Structure: Size medium; body obese and slightly depressed. Carapace essentially normal; rather broad, head slightly elevated. Clypeus very slightly protruding; height about 2.5 diameters of a. s. eye. Eye area occupies about 0.8 width of head; a. m. eye a little smaller than the others. Posterior eye row slightly procurved; p. m. eye about 1.1 diameter apart, 1.0 diameter from side eye. Anterior row slightly procurved; a. m. eye about 0.6 diameter apart, a 1.4 diameters from side eye. Median ocular quadrangle slightly longer than wide, wider behind.

Chelicerae small, reclined; fang normal, without the usual double curve. Sternum large, broad, as wide as long, truncate behind; separates hind coxae by 1.5 diameters. Legs moderately small. Abdomen large, rounded, somewhat depressed dorso-ventrally; with a large dorsal sclerite, which is nearly round, and which covers the entire dorsal surface except for a narrow margin all around; with a small sclerite at each end of the genital furrow which joins the epigynum plates. Epigynum somewhat elevated anteriorly; with a small cup-like depression on anterior edge; posterior structures typical.

Measurements:

♀

	Mm.	*Ratio*
Length	1.90	253
Carapace:		
Length	0.75	100
Width	0.71	95
Tibia-patella:		
1	0.70	93
4	0.80	107

Type locality.—ALASKA: Palmer, October 16, 1943, ♀, J. C. Chamberlin.

Ceratinella placida Banks

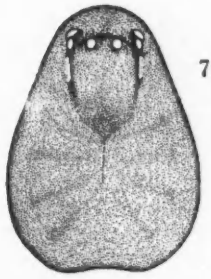
Figs. 22, 23

Ceratinella placida Banks, 1892, Proc. Phil. Acad. Sci., p. 32; *2: 54.

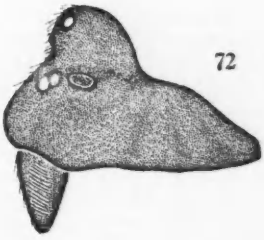
Male, female.—*Color:* Carapace dark brown. Chelicerae light brown. Endites light brown, with whitish tips. Sternum and labium dusky brown. Legs and palpi light yellowish brown; tibia and tarsus of male palpus brown. Abdomen with soft parts dark gray; sclerites dark reddish brown; dorsal sclerite shaded with dusky on borders. Spinnerets light brown.

EXPLANATION OF PLATE VII

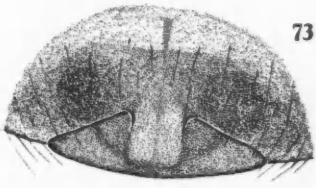
71. *Lophomma columbia* new species. Cephalothorax, dorsal view. 72. *Lophomma columbia* new species. Cephalothorax, lateral view. 73. *Lophomma columbia* new species. Epigynum, ventral aspect. 74. *Lophomma columbia* new species. Epigynum, caudal aspect. 75. *Lophomma columbia* new species. ♂ palpus. 76. *Lophomma columbia* new species. Patella, tibia and bars of cymbium of ♂ palpus. 77. *Oedothorax cascadeus* new species. Epigynum, ventral aspect. 78. *Oedothorax cascadeus* new species. Epigynum, caudal aspect. 79. *Sciastes tenna* new species. Epigynum, ventral view. 80. *Sciastes tenna* new species. Epigynum, caudal view.



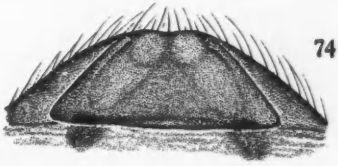
71



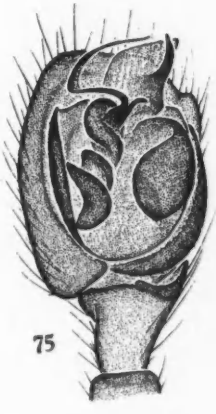
72



73

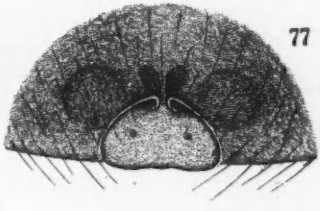


74

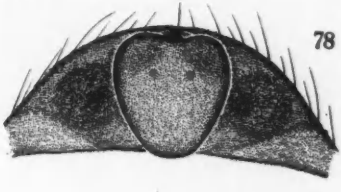


75

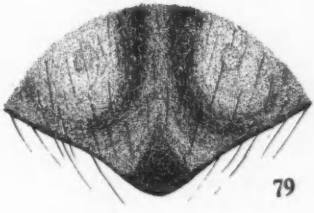
76



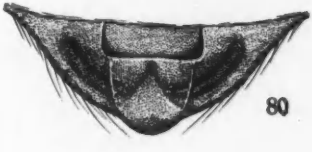
77



78



79



80

Structure: Size medium; moderately robust. Carapace typical; a little wider in male, otherwise similar in both sexes. Clypeus vertical; height 2.5 diameters of a. s. eye in female, 3.0 diameters in male. Eye area occupies nearly 0.8 width of head; a. m. eye much smaller than the others, lens tends to be conical in shape. Posterior eye row very slightly procurved; p. m. eye about 1.1 diameters apart, 1.1 diameters from side eyes. Anterior row straight; a. m. eye about 0.5 diameter apart, 0.9 diameter from side eye. Median ocular quadrangle a little longer than wide, wider behind.

Chelicerae typical; fang with usual double curve. Sternum and legs typical. Abdomen with dorsal sclerite in both sexes; large, covering entire dorsum in male; smaller, covering one-half to two-thirds of the diameters of the abdomen in the female. Ventral sclerites typical. Epigynum not significantly different from that of ***brunnea***.

Male palpus similar to ***brunnea*** except that the spur on the tibia is long.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.60	235	1.80	240
Carapace:				
Length	0.68	100	0.75	100
Width	0.64	94	0.65	87
Tibia-patella:				
1	0.62	91	0.61	81
4	0.67	99	0.72	96

Type locality.—NEW YORK: Ithaca.

Other records.—ALASKA: Homer, July 20–25, 1945, J. C. Chamberlin. MICHIGAN: Albion, June 16, 1933, ♀, W. Ivie. ONTARIO: So. Tea Lake, Algonquin Park, July 3 and 10, 1945, ♂♂ ♀♀, W. Ivie and T. B. Jurata.

Ceratinella tigana, new species

Fig. 24

Certinella placida (in part), Chamberlin and Ivie, 1947, Bull. Univ. Utah, Biol. Ser., 10(3): 30.

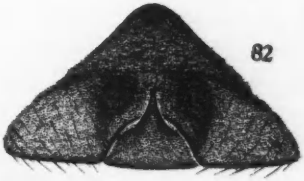
Female.—Color: Carapace dark brown. Chelicerae and endites brown, with lighter tips. Sternum and labium dusky brown. Legs and palpi orange brown. Abdomen with soft parts dark purplish gray; dorsal sclerite dark brown; ventral sclerites lighter brown, the one surrounding the spinnerets crossed radially with bands of dusky at the sides and above.

Structure: Size medium to small. Structure essentially typical.

EXPLANATION OF PLATE VIII

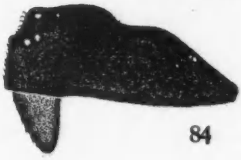
82. *Spirembolus vasingtonus* new species. Epigynum. 83. *Minyriolus pampia* new species. Cephalothorax, dorsal view. 84. *Minyriolus pampia* new species. Cephalothorax, lateral view. 85. *Minyriolus pampia* new species. ♂ palpus, ventral view. 86. *Minyriolus pampia* new species. ♂ palpus, sublateral view. 87. *Minyriolus pampia* new species. Patella and tibia of ♂ palpus. 88. *Minyriolus plenus* new species. Cephalothorax, dorsal view. 89. *Minyriolus plenus* new species. Cephalothorax, lateral view. 90. *Minyriolus plenus* new species. Epigynum. 91. *Minyriolus plenus* new species. ♂ palpus. 92. *Minyriolus plenus* new species. Patella and tibia of ♂ palpus.

81



82

83

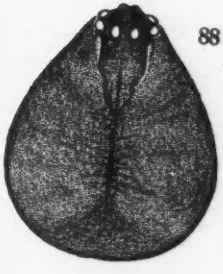


84

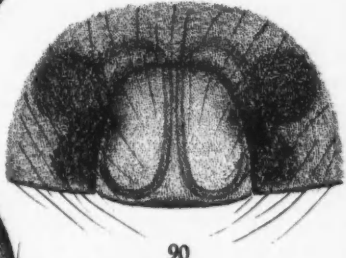
87

86

85

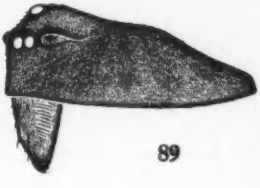


88



90

92



89

91

Carapace wide in thoracic part. Clypeus vertical; height about 2.8 diameters of a. s. eye. Eye area occupies about 0.8 width of head; a. m. eye smaller than the others, lens conical. Posterior eye row slightly procurved; p. m. eye about 1.0 diameter apart, 0.9 diameter from side eye in type (1.6 diameters apart, 0.8 diameter from side eye in paratype). Anterior row slightly procurved; a. m. eye about 0.6 diameter apart, 0.7 diameter from side eye, (0.5 diameter apart, 0.9 diameter from side eye in paratype). Median ocular quadrangle a little wider than long, wider behind. Chelicerae vertical; fang with usual double curve.

Legs and sternum normal. Abdomen with large dorsal sclerite, covering about 0.70 of length and 0.75 of width, edge slightly irregular; spinnerets completely surrounded by a moderately wide sclerite. Epigynum similar in shape to that of ***brunnea***, except the middle lobe is not distinctly separated from anterior part.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.75	250
Carapace:		
Length	0.70	100
Width	0.66	94
Tibia-patella:		
1	0.60	86
4	0.66	94

Type locality.—ALASKA: Haines, August 23, 1945, ♀, J. C. Chamberlin; Matanuska, August-October, 1943, J. C. Chamberlin (paratype).

This species differs from ***placida*** mainly in smaller size, narrower head; spinnerets completely surrounded with a sclerite, in ***placida*** the sclerite extends only about half way around; epigynum different in structure of middle lobe.

In spite of the differences in eye distances of the two specimens, they undoubtedly belong to the same species.

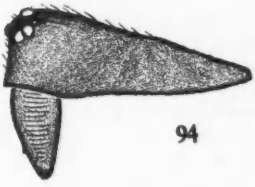
Ceratinella tosior, new species

Female.—Color: Carapace dark brown. Chelicerae brown, light brown distally. Endites brown, with grayish white tips. Sternum and labium dark dusky brown. Legs and palpi light brown, the coxae narrowly bordered with dusky at distal end. Abdomen with sclerites dark reddish brown, the dorsal sclerite shaded with dusky on the borders; rest of abdomen dark slate gray. Spinnerets light brown. Epigynum mostly reddish brown.

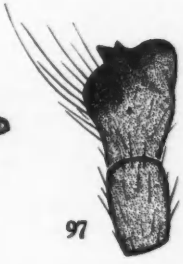
EXPLANATION OF PLATE IX

93. *Masoncus nogales* new species. Cephalothorax, dorsal view. 94. *Masoncus nogales* new species. Cephalothorax and chelicerae, lateral view. 95. *Masoncus nogales* new species. Epigynum. 96. *Masoncus nogales* new species. ♂ palpus, lateral view. 97. *Masoncus nogales* new species. Patella and tibia of ♂ palpus. 98. *Masoncus nogales* new species. Mesoventral view. 99. *Masoncus arienus* new species. Cephalothorax, dorsal view. 100. *Masoncus arienus* new species. Epigynum. 101. *Masoncus arienus* new species. ♂ palpus, ventral view. 102. *Masoncus arienus* new species. Patella and tibia of ♂ palpus, dorsal view.

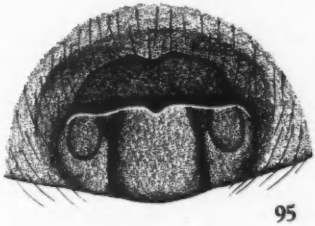
93



94



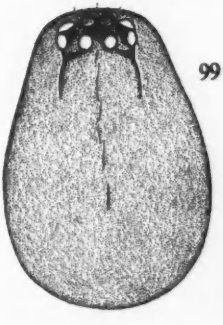
97



95

98

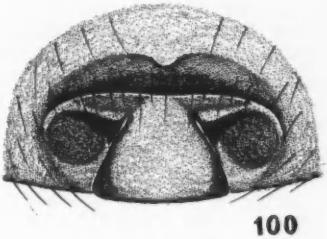
96



99

101

102



100

Structure: Size medium to small. Carapace typical. Clypeus vertical; height a full 2 diameters of a. s. eye. Eye area occupies nearly 0.8 width of head; a. m. eye smaller than the others. Posterior eye row slightly procurved; p. m. eye about 1.1 diameters apart, 1.0 or 0.9 diameter from side eye. Anterior row faintly procurved; a. m. eye about 0.4 diameter apart, 0.7 diameter from side eye. Chelicerae, sternum, and legs typical. Abdomen of usual shape; dorsal sclerite large, nearly flat, covers nearly 0.75 of length, more than 0.75 of width; sclerite in front of spinnerets extends forward more than usual, extends about 0.4 distance from spinnerets to genital furrow. Epigynum not significantly different from that of ***brunnea.***

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.65	246
Carapace:		
Length	0.67	100
Width	0.60	90
Tibia-patella:		
1	0.50	75
4	0.57	85

Type locality.—MISSOURI: Columbia, July, 1905, ♀.

This species is very close to ***brunnea***, but can be readily distinguished by its darker color. The legs are light brown instead of bright golden yellow. The abdominal sclerites are dark reddish brown, instead of bright reddish brown.

Genus **Ceratinops** Banks, 1905

Amer. Naturalist, 39: 309.

Generotype: *Ceratinops annulipes* (Banks).

Ceratinops uintana, new species

Figs. 27, 28

Female.—Color: Carapace dark shiny brown. Chelicerae reddish brown. Endites reddish brown with pale tips. Sternum and labium dark dusky brown. Legs and palpi brownish yellow. Abdomen dark gray; sclerite around spinnerets reddish brown, crossed by radial bands of dusky. Spinnerets orange brown. Epigynum dusky brown.

Structure: Size about that of a *Ceratinella*. General structure slightly flattened and broadened. Carapace ovoid; head narrow and slightly elevated. Height of clypeus about 3.0 diameters from a. s. eye. Eye area occupies three-fourths width of head at posterior lateral eyes. Posterior eye row strongly procurved; eyes about a diameter apart.

Anterior eye row slightly procurved; a. m. eyes about 0.5 diameter apart, about 1.1 diameters from much larger side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae vertical; fang groove with four small teeth in front, four denticles behind. Sternum truncate behind, separating hind coxae by more than a diameter. Legs moderately short; leg 4 decidedly longer than leg 1. Abdomen flattened and broadened; with a sclerite

surrounding the spinnerets. Epigynum small; two openings; posterior sclerite broad and short.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.85	247
Carapace:		
Length	0.75	100
Width	0.65	87
Tibia-patella:		
1	0.65	89
4	0.77	103

Type locality.—UTAH: Mirror Lake, Uintah Mts., September 22, 1932, ♀; August 18, 1942.

Other record.—UTAH: Provo River at Cobble Rest, September 24, 1932, ♀.

Genus **Ceratinopsis** Emerton, 1882

Trans. Conn. Acad. Sci., 6: 36.

Generotype: *Ceratinopsis interpres* (Cambridge).

Ceratinopsis eutypa, new species

Fig. 36

Female.—Color: Carapace light brown; eyes on black spots. Chelicerae and endites reddish brown, lighter at the distal ends. Sternum and labium dusky brown. Legs and palpi light yellowish brown. Abdomen black. Spinnerets and epigynum dusky brown.

Structure: Size medium. Carapace essentially normal. Height of clypeus about 2.5 diameters of a. s. eye. Eyes slightly raised; a. m. eyes much smaller than the others; eye area occupies about 0.6 width of head. Posterior eye row straight; p. m. eye 1.9 diameters apart, 0.9 diameter from side eyes. Anterior row straight; a. m. eyes 0.8 diameter apart, 1.1 diameters from side eye. Median ocular quadrangle very slightly longer than wide, wider behind than in front.

Chelicerae vertical, moderately stout; front bears a number of setigerous granules, especially on the ectal corner; fang groove with five large teeth in front, four small teeth behind. Sternum normal; separates hind coxae by about a diameter. Epigynum, as seen from ventral view, consists of a small plate, straight across rear, somewhat narrowed anteriorly, with a large median point extending forward over the rim with an obtusely angular ridge far forward near the pedicel.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.10	200
Carapace:		
Length	1.05	100
Width	0.75	71
Tibia-patella:		
1	1.00	95
4	1.03	98

Type locality.—WASHINGTON: Rainier Park, August 9, 1929, ♀, R. V. Chamberlin.

Other records.—BRITISH COLUMBIA: Parksville, Sept. 13, 1935, ♀, W. Ivie; Sidney, V. I., Sept. 16, 1935, ♀, W. Ivie. OREGON: Comstock, Sept. 9, 1935, ♀, R. V. Chamberlin.

Ceratinopsis (?) oregonicola, new species

Fig. 37

Female.—Color: Carapace light yellowish brown, with radial streaks and sides of head a slightly darker brown, and with a large diffuse pale spot on back of head; eyes on black spots. Chelicerae light yellowish brown. Endites orange with pale tips. Sternum light yellowish brown, labium lightly shaded with dusky. Legs and palpi pale brown, with joints a little lighter. Abdomen gray. Spinnerets pale yellowish. Epigynum yellowish brown and light dusky.

Structure: Size small. Carapace normal; top of head moderately convex; clypeus nearly vertical, very slightly protruding, height about 1.8 diameters of a. s. eye. Eye area occupies about 0.6 width of head; a. m. eyes much smaller than the others. Posterior eye row faintly recurved; p. m. eye about 0.9 diameter apart, 0.8 diameter from side eyes. Anterior row straight; a. m. eye about 0.4 diameter apart, 0.6 diameter from side eyes. Median ocular quadrangle barely wider than long, much wider behind than in front.

Chelicerae slightly reclined; stridulating file weak; fang groove with five teeth in front, four teeth behind. Sternum moderately large, slightly convex; separates hind coxae by slightly more than a diameter. Legs moderately short. Abdomen normal. Epigynum has a widely extended posterior sclerite which is joined to the anterior rim by a narrow median isthmus to form a wide, inverted T-shaped structure; an open space between the posterior sclerite and the anterior rim near the middle of each side is filled with a smooth convex swelling; an anterior depression in front on each side.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.40	233
Carapace:		
Length	0.60	100
Width	0.48	80
Tibia-patella:		
1	0.46	77
4	0.56	93

Type locality.—OREGON: Jackson Co., April 6, 1927, 2 ♀, J. C. Chamberlin.

Ceratinopsis crosbyi, new species

Fig. 38

Female.—Color: Carapace brown, lightly marked with dusky. Chelicerae reddish brown. Sternum, labium, and endites dusky brown. Legs and palpi yellowish brown. Abdomen blackish. Spinnerets and epigynum dusky brown.

Structure: Size medium to small; structure essentially normal; body

slightly elongate. Eye area occupying about 0.7 width of head. Lateral eyes slightly more elevated than usual. Clypeus nearly vertical; height about 2.2 diameter of an a. s. eye. Eyes unequal, the descending order of size being a. s., p. s., p. m., a. m. Posterior eye row slightly procurved; p. m. eyes about 1.3 diameters apart, about 0.7 diameter from sides eyes. Anterior row faintly recurved; a. m. eyes about 0.4 diameter apart, about 1.0 diameter from side eyes. Median ocular quadrangle a little longer than wide, wider behind than in front. Chelicerae slightly reclined; fang groove with four large, short teeth in front. Legs normal; fourth leg distinctly longer than first. Epigynum has a large posterior plate, with a large median notch in front; openings separated and located anteriorly; a small elongate oval structure present on the median line between the openings.

Measurements

	♀	
	Mm.	*Ratio*
Length	1.80	225
Carapace:		
Length	0.80	100
Width	0.63	79
Tibia-patella:		
1	0.70	88
4	0.83	104

Type locality.—COLORADO: Pingree Park, Larimer Co., Aug. 20 1924, ♀, C. R. Crosby.

Ceratinopsis palomara, new species

Figs. 39, 40

Female.—Color: Carapace light brown, lightly marked with dusky; a distinct black spot below the a. m. eyes. Chelicerae light brown. Endites brownish orange with lighter tips. Sternum and labium dusky brown. Legs and palpi light brown. Abdomen gray. Spinnerets yellowish. Epigynum light yellowish and dusky brown.

Structure: Size medium. Carapace normal. Height of clypeus about 2.5 diameters of a. s. eye. Eyes about average; a. m. eyes much smaller than the others; eye area occupies about 0.6 width of head. Posterior eye row faintly recurved, p. m. eyes about 0.9 diameter apart, 0.8 diameter from side eyes. Anterior row straight; a. m. eyes 0.3 diameter apart, 1.1 diameter from side eyes. Median ocular quadrangle slightly wider than long; much wider behind than in front.

Chelicerae vertical; fang groove with five large teeth in front, four small teeth behind. Legs, sternum, and abdomen normal. Epigynum as shown in the figures.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.05	228
Carapace:		
Length	0.90	100
Width	0.75	83
Tibia-patella:		
1	0.91	101
4	0.95	106

Type locality.—CALIFORNIA: Santa Barbara.

Other record.—CALIFORNIA: Mt. Palomar (summit), July 26, 1931, ♀, R. V. Chamberlin and W. Ivie.

Ceratinopsis secuta, new species

Fig. 35

Female.—Color: Carapace light brown with diffuse dusky markings of the usual pattern. Chelicerae light brown. Endites dusky orange brown. Sternum and labium dark dusky brown. Legs and palpi light yellowish brown. Abdomen dark gray or black. Spinnerets dusky brown. Epigynum mostly white.

Structure: Size medium to large. Carapace essentially normal; head moderately broad, rounded across front, slightly convex back of eyes. Clypeus slightly protruding, height about 3.5 diameters of an a. s. eye. Median groove indistinct. Eye area occupies about 0.6 width of head; eyes moderately small, a. m. eyes much smaller than the others; lateral eyes slightly elevated. Posterior eye row slightly recurved; p. m. eyes about 1.0 diameter apart, 1.0 diameter from side eyes. Anterior row slightly recurved; a. m. eyes about 0.4 diameter apart, 1.5 diameters from side eyes. Median ocular quadrangle about as wide as long, much wider behind than in front.

Chelicerae vertical; fang groove with three large teeth in front, four or five smaller teeth, closely spaced, behind. Sternum wide in front, pointed behind; hind coxae separated by slightly less than a diameter. Abdomen moderately large. Spinnerets surrounded by a slightly elevated fold in the integument. Epigynum moderately large; middle part soft, white.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.70	245
Carapace:		
Length	1.10	100
Width	0.85	77
Tibia-patella:		
1	1.08	99
4	1.10	100

Type locality.—CALIFORNIA: 15 mi. W. Santa Monica, March 20, 1941, 4 ♀, W. Ivie.

Ceratinopsis gosibia, new species

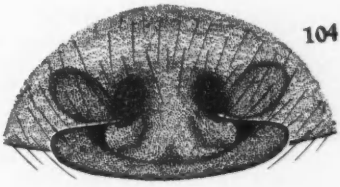
Figs. 29–32

Male, female.—Color: Carapace yellowish brown. Chelicerae and

EXPLANATION OF PLATE X

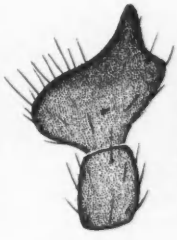
103. *Masoncus dux* new species. Epigynum. 104. *Scironis autor* new species. Epigynum. 105. *Scironis sima* new species. Palpus of ♂, ventral view. 106. *Scironis sima* new species. Tibia and patella of ♂ palpus, dorsal view. 107. *Scylaceus amylus* new species. Epigynum. 108. *Scylaceus divisus* new species. Epigynum. 109. *Spirembolus cheronus* new species. Epigynum, ventral view. 110. *Spirembolus cheronus* new species. Epigynum, caudal view. 111. *Spirembolus maderus* new species. Epigynum. 112. *Spirembolus orthus* new species. Epigynum. 113. *Cheraira kena* new species. Epigynum.

103

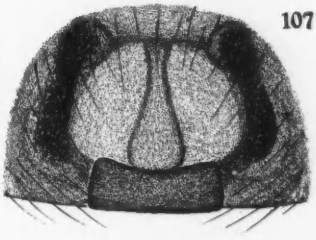


104

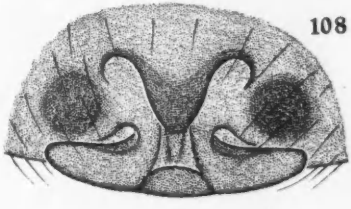
105



106

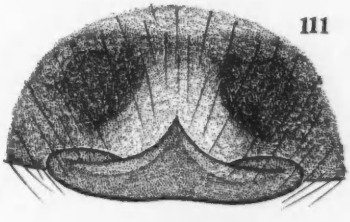


107



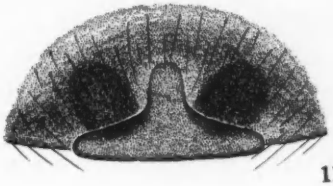
108

109



111

110



112

113

endites light orange brown. Sternum brownish orange. Legs and palpi pale brownish yellow. Abdomen grayish white. Spinnerets light yellowish. Epigynum reddish brown and dusky.

Structure: Size medium. Carapace slightly broader than usual; head moderately broad, not modified in the male; median groove absent. Height of clypeus 2.5 to 3.0 diameters of an a. s. eye. Eye area occupies 0.7 width of head or more. Eyes subequal; size medium. Posterior eye row straight; p. m. eyes about 1.0 diameter apart, about 0.8 diameter from side eyes. Posterior row faintly procurved; a. m. eyes 0.3 diameter apart, 0.5 diameter from side eyes. Median ocular quadrangle about as wide as long, a little wider behind than in front.

Chelicerae vertical; moderately stout; fang groove with five teeth in front, three behind. Sternum large; separates hind coxae by more than 1.5 diameters. Legs slender; coxae short. Abdomen normal.

Palpus with patella short, scarcely longer than wide; tibia wide, broad projected ectad; cymbium normal; paracymbium vestigial, being a very small piece attached to ectal base of cymbium and bearing a few hairs. Embolic division with a hairy tail-piece, with a distal black spine, below the point of which is attached a long curved lash.

Epigynum with a large posterior plate, in front of which are the two openings separated by a narrow septum; in front, the epigynum is extended forward in a rounded process.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.65	227	1.65	220
Carapace:				
Length	0.73	100	0.75	100
Width	0.60	82	0.60	80
Tibia-patella:				
1	0.70	96	0.70	93
4	0.75	103	0.77	103

Type locality.—ARIZONA: Creek 8 mi. No. Roosevelt Dam, April 11, 1935, ♂ ♀, W. Ivie.

Other record.—ARIZONA: No. Sasabe, January 1, 1941, ♀, D. and S. Mulaik.

Ceratinopsis interventa, new species

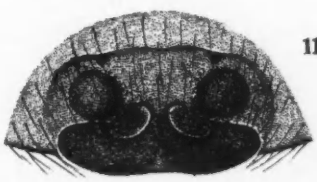
Fig. 34

Female.—Color: Carapace light yellowish brown; eyes on black spots. Chelicerae light brown. Endites yellowish. Sternum and

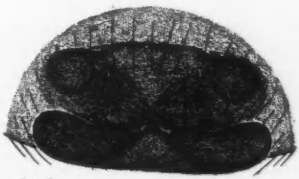
---

EXPLANATION OF PLATE XI

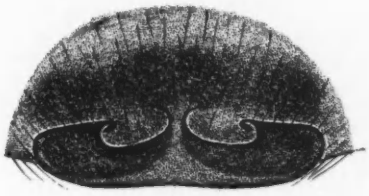
114. *Cheraira salmonis* new species. Epigynum. 115. *Cheraira castoris* new species. Epigynum. 116. *Cheraira willapa* new species. Epigynum. 117. *Tapinocyba* (?) *kesimba* new species. Epigynum. 118. *Tapinocyba kesimba* new species. Cephalothorax, lateral view. 119. *Tapinocyba kesimba* new species. Palpus of ♂, lateral view. 120. *Tapinocyba kesimba* new species. Palpus of ♂, embolic division, mesoventral view. 121. *Tapinocyba kesimba* new species. Patella and tibia of ♂ palpus. 122. *Tapinocyba sucra* new species. Epigynum, ventral view. 123. *Tapinocyba sucra* new species. Epigynum, caudal view. 124. *Tapinocyba iowa* new species. Epigynum, ventral view. 125. *Tapinocyba iowa* new species. Epigynum, caudal view.



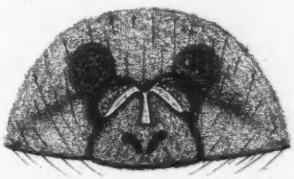
114



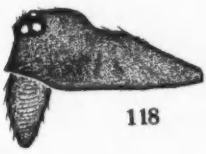
115



116



117



118

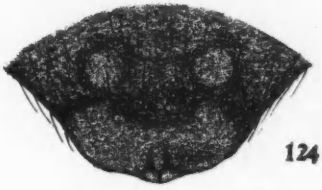
120

119

121

122

123



124

125

labium dusky brown, darker on the margins. Legs and palpi yellowish. Abdomen light to dark gray. Spinnerets light brownish yellow. Epigynum yellowish, brownish and dusky.

Structure: Size medium; general shape moderately obese. Carapace essentially normal, moderately broad; median groove absent; clypeus slightly protruding, height about 1.6 diameters of a. s. eye. Eye area occupies about 0.8 width of head at posterior eye row; eyes moderately large; a. m. eyes a little smaller than others. Posterior eye row faintly recurved; p. m. eyes 0.9 diameter apart, 0.9 diameter from side eyes. Anterior row slightly procurved; a. m. eyes about 0.3 diameter apart, 0.5 diameter from side eyes. Median ocular quadrangle faintly wider than long, wider behind than in front. Chelicerae vertical, moderately stout; without stridulating file; fang groove with three teeth on each margin. Sternum moderately large and wide; separates hind coxae by a full diameter. Setae on legs and palpi moderately long and coarse. Abdomen large. Epigynum moderately large, with a transverse bar behind, in front of which is a large depressed plate, bearing a pair of dusky marks, and bordered on the sides with a black rim.

Measurements:

♀	*Mm.*	*Ratio*
Length	2.00	267
Carapace:		
Length	0.75	100
Width	0.63	84
Tibia-patella:		
1	0.66	88
4	0.75	100

Type locality.—ARIZONA: Cr. 8 mi. No. Roosevelt Dam, April 11, 1935, 2 ♀.

Ceratinopsis (?) watsinga, new species

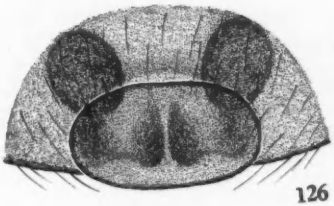
Fig. 33

Female.—Color: Carapace light yellowish brown; the a. m. eyes on a black spot. Chelicerae and endites light brownish orange. Sternum light brownish yellow; labium more dusky. Legs and palpi light yellowish. Abdomen pale gray. Spinnerets light yellowish. Epigynum yellowish brown and dusky.

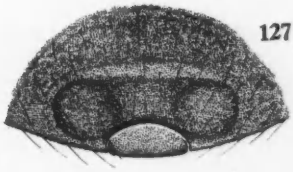
Structure: Size medium. Carapace and head moderately broad. Height of clypeus about 4 diameters of a. s. eyes. Eye area occupies about 0.6 the width of the head. Eyes small, descending order of size being a. s., p. s., a. m., p. m. Posterior eye row straight; the small p. m.

EXPLANATION OF PLATE XII

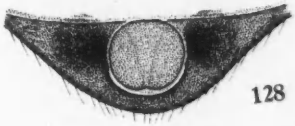
126. *Tapinocyba phana* new species. Epigynum. 127. *Tapinocyba pontis* new species. Epigynum, ventral aspect. 128. *Tapinocyba pontis* new species. Epigynum, caudal aspect. 129. *Tapinocyba idahona* new species. Epigynum, ventral aspect. 130. *Tapinocyba idahona* new species. Epigynum, caudal aspect. 131. *Tigellinus perditus* new species. Epigynum. 132. *Tigellinus mesus* new species. Epigynum. 133. *Tachygyna watona* new species. Epigynum, ventral view. 134. *Tachygyna watona* new species. Epigynum, dorsal view. 135. *Tachygyna paita* new species. ♂ palpus, ventral aspect. 136. *Tachygyna paita* new species. Patella and tibia of ♂ palpus.



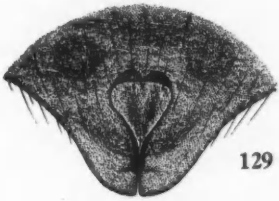
126



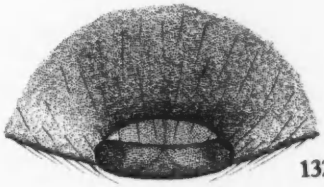
127



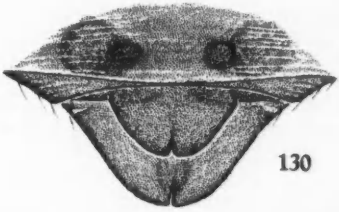
128



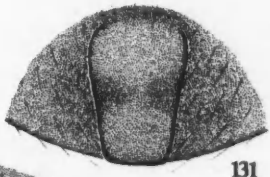
129



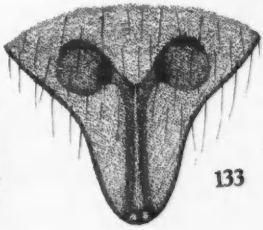
132



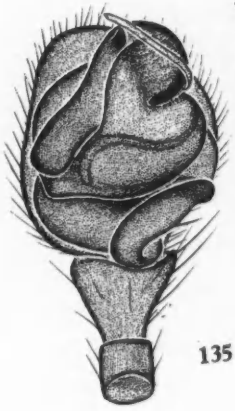
130



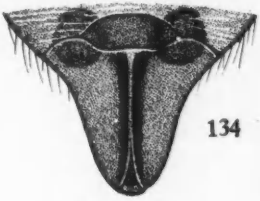
131



133



135



134

136

eyes about 1.6 diameters apart, about 2 diameters from the side eyes. Anterior row slightly recurved; the a. m. eyes about 0.6 diameter apart, about 1.1 diameters from side eyes. Median ocular quadrangle slightly longer than wide, slightly wider behind than in front.

Chelicerae vertical; fang groove with five teeth in front. Sternum large; separates hind coxae by more than one diameter. Legs and palpi slender. Abdomen moderately large. Epigynum large, with a wide transverse plate behind, which contains the openings, and a stout conical process in front.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.75	233
Carapace:		
Length	0.75	100
Width	0.60	80
Tibia-patella:		
1	0.86	115
4	....	....

Type locality.—No data, but probably from vicinity of Salt Lake City, Utah, about 1930. ♀.

Genus **Cheraira** new

This genus is proposed for a group of western species agreeing among themselves in a distinctive form of the epigynum the features of which can best be appreciated from the figures for the several species described below. The affinition of the genus appear to be with ***Spirembolus*** and its allies, but in the lack of knowledge of the males cannot be determined definitely.

Orthotype: *Cheraira kena* new species.

Only the four new species described below are at present known to belong in this group.

Cheraira willapa, new species

Fig. 116

Female.—Color: Carapace brown, lightly marked with dusky. Chelicerae reddish brown. Endites orange brown with pale tips. Sternum and labium dark dusky over yellow. Legs and palpi bright yellowish orange. Abdomen blackish. Spinnerets brown, lightly shaded with dusky. Epigynum dusky brown.

Structure: Size moderately large. Carapace normal in outline; head slightly elevated. Clypeus slightly protruding; height about 3.5 diameters of a. s. eye. Eye area occupies about 0.6 width of head; a. m. eyes much smaller than the a. s. eyes, which are a little longer than the posterior eyes. Posterior eye row straight; p. m. eyes about 1.3 diameters apart, about 1.3 diameters from side eyes. Anterior row straight; a. m. eyes about 0.8 diameter apart, about 2.0 diameters from side eyes. Median ocular quadrangle about as wide as long, wider than in front.

Chelicerae vertical, stout, convex in front near base; fang groove with five large, widely spaced teeth in front, with four tiny teeth near

base of fang in rear. Sternum normal. Legs moderately robust. Epigynum with a wide transverse lobe, containing a pair of transverse openings anteriorly and mesally, separated by a short narrow septum; without small pits in front as in *castoris*.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.75	220
Carapace:		
Length	1.25	100
Width	0.90	72
Tibia-patella:		
1	1.15	92
4	1.25	100

Type locality.—WASHINGTON: Willapa R., August 8, 1929, 2 ♀, R. V. Chamberlin.

Other records.—WASHINGTON: Paradise Valley, July 17–22, 1932; Denny Cr. Camp, Snoqualine Pass, September 16, 1935. 8 ♀.

Cheraira kena, new species

Fig. 113

Female.—Color: Carapace light yellowish brown, with a black spot below the a. m. eyes and joining them. Chelicerae orange brown. Endites orange. Sternum and labium yellowish. Legs and palpi light orange brown. Abdomen light gray. Spinnerets pale orange brown. Epigynum light reddish brown and dusky.

Structure: Size large. Carapace normal; head slightly humped back of eyes. Height of clypeus about 3 diameters of an a. s. eye. Eye area occupies about two-thirds width of head at posterior eye row. Eyes moderately small; subequal, the descending order of size being a. s., p. s., p. m., a. m. Posterior eye row slightly recurved; p. m. eyes about 1.5 diameters apart, 1.2 diameters from side eyes. Anterior row faintly recurved; a. m. eyes about 0.3 diameter apart, about 1.0 diameter from side eyes. Median ocular quadrangle wider than long, much wider behind than in front.

Chelicerae nearly vertical, slightly reclined; fang groove with five long teeth in front, five small teeth behind. Sternum normal, separates hind coxae by about a diameter. Legs long, moderately robust. Abdomen moderately high and elongate, pointed behind; resembles a typical linyphiid. Epigynum large, with a wide transverse sclerite behind; in front of which are the openings separated by a narrow septum; in front, is a ridge, containing a pair of small cavities.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.65	232
Carapace:		
Length	1.14	100
Width	0.87	76
Tibia-patella:		
1	1.20	105
4	1.27	111

Type locality.—UTAH: Mirror Lake, Uintah Mts., July 28, 1936, 4 ♀, W. Ivie.

Other records.—UTAH: Ferron Res., Wasatch Plateau, June 24, 1934, ♀, Ivie & Rasmussen.

Cheraira castoris, new species

Fig. 115

Female.—Color: Carapace light brown, lightly shaded with dusky. Chelicerae and endites light orange brown. Sternum and labium dusky brown. Legs and palpi orange brown. Abdomen medium gray. Spinnerets yellowish. Epigynum reddish brown and dusky.

Structure: Carapace normal; head slightly humped back of eyes. Height of clypeus about 3 diameters of an a. s. eye. Eye area occupies about two-thirds width of head. Eyes small; a. s. largest; a. m. smallest. Posterior eye row recurved; p. m. eyes about 1.0 diameter apart, 1.0 diameter from side eyes. Anterior row straight; a. m. eyes subcontiguous, about a diameter or a little more from the side eyes. Median ocular quadrangle a little wider than long, wider behind than in front.

Chelicerae vertical; fang groove with five teeth on each side, those in front larger. Epigynum large, resembling *willapa* and *salmonis* with differences in details.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.50	227
Carapace:		
Length	1.10	100
Width	0.80	73
Tibia-patella:		
1	1.02	93
4	1.10	100

Type locality.—UTAH: Beaver Canyon, June 7, 1934, 2 ♀, W. Ivie and H. A. Rasmussen.

Cheraira salmonis, new species

Fig. 114

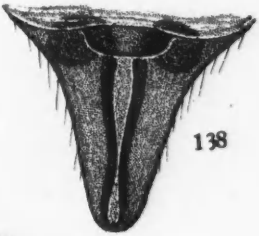
Female.—Color: Carapace light brown with black spot on clypeus, including the a. m. eyes. Chelicerae and endites light reddish brown. Sternum light dusky yellow; labium dusky. Legs and palpi yellow. Abdomen light gray. Spinnerets yellow. Epigynum reddish brown.

Structure: Posterior eye row slightly recurved; p. m. eyes scarcely larger than a. m. eyes, 1.3 diameters apart, same distance from side eyes.

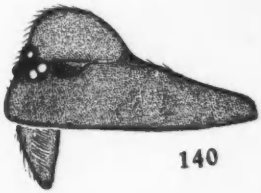
EXPLANATION OF PLATE XIII

137. *Tachygyna sima* new species. Epigynum, ventral view. 138. *Tachygyna sima* new species. Epigynum, dorsal view. 139. *Tortembolus monicus* new species. Epigynum. 140. *Tortembolus approximatus* new species. Cephalothorax and chelicerae of ♂, lateral view. 141. *Tortembolus approximatus* new species. Palpus of ♂, sublateral view. 142. *Tortembolus approximatus* new species. Patella and tibia of ♂ palpus. 143. *Tortembolus approximatus* new species. Epigynum, ventral view. 144. *Tortembolus approximatus* new species. Epigynum, caudal view. 145. *Wubana reminiscens* new species. Epigynum. 146. *Willibaldia sodonta* new species. Epigynum, ventral view.

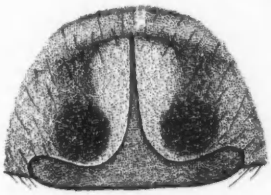
137



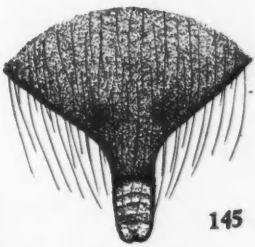
138



140



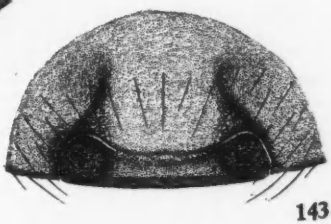
139



145

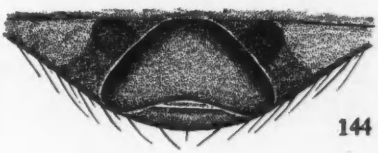
141

142



143

146



144

Median ocular quadrangle about as wide as long. Epigynum as shown in the figures.

Measurements:

	♀ *Mm.*	*Ratio*
Length	1.95	230
Carapace:		
Length	0.85	100
Width	0.65	76
Tibia-patella:		
1	0.87	102
4	0.94	111

Type locality.—IDAHO: Salmon Falls, near Castleford, April 12, 1932, 2 ♀, J. C. Chamberlin.

Genus **Cochlembolus** Crosby, 1929

Ent. News 40: 79.

Generotype: *Cochlembolus alpinus* (Banks).

Cochlembolus provo, new species

Fig. 54

Carapace dull yellow, with a shield-shaped dusky area on posterior part of head and radiating dark lines on thorax, the lateral border of which is also black. Legs and endites yellow. Sternum and labium dusky yellow. Abdomen black throughout excepting a yellow ventral area in front of the genital furrow.

Posterior row of eyes distinctly recurved; median eyes more than their radius apart, closer to the laterals. Anterior row of eyes straight; eyes subcontiguous, the medians much smaller than the laterals. Quadrangle of median eyes much narrower in front than behind.

Epigynum as shown in fig. 54.

Length, 1.4 mm.

Type locality.—UTAH: Cobble Rest, Upper Provo River, July 30, 1936.

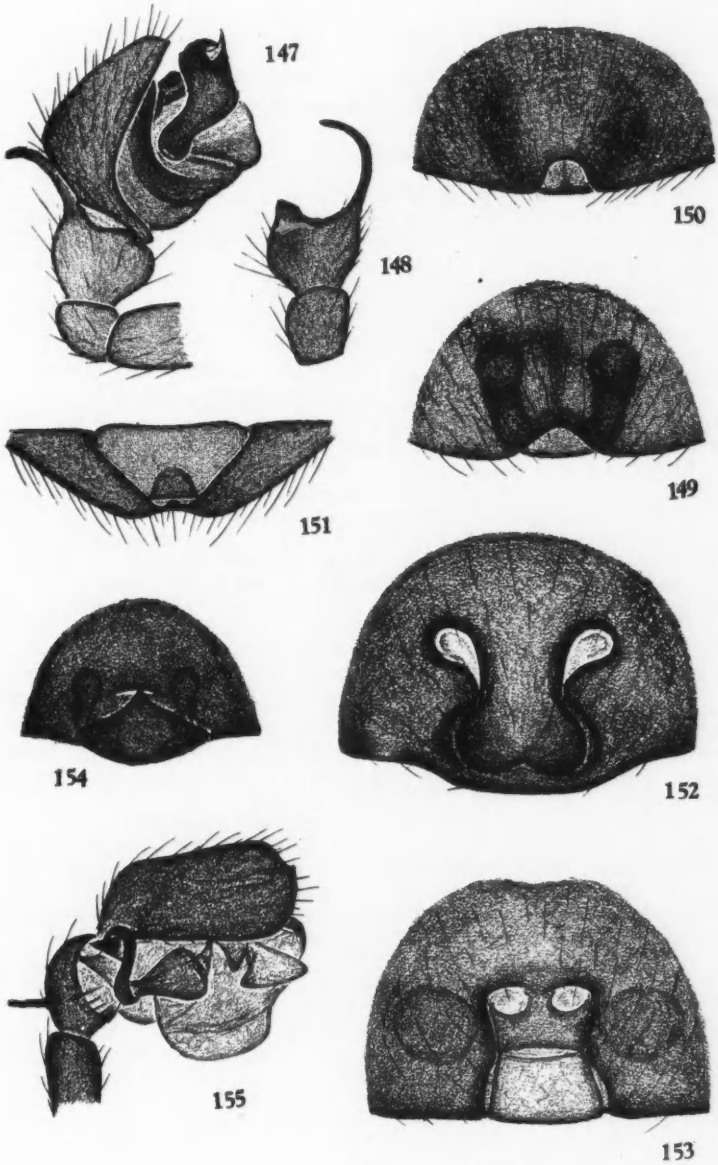
Genus **Coloncus,** new

A genus apparently related to *Araeoncus*. It is here set apart primarily on the basis of the distinctive structure of the epigynum which anteriorly is limited by a transverse ridge or sclerite behind which is a median septum which is narrow over its middle length and expanded into a deltoid plate caudally as shown in figs. 48–52.

Orthotype: *Coloncus pius* new species.

EXPLANATION OF PLATE XIV

147. *Zygottus corvallis* new species. Palpus of ♂, lateral view. 148. *Zygottus corvallis* new species. Patella and tibia of ♂ palpus, dorsal view. 149. *Zygottus corvallis* new species. Epigynum. 150. *Zygottus oregonus* new species. Epigynum, ventral view. 151. *Zygottus oregonus* new species. Epigynum, caudal view. 152. *Tapinocyba vermontis* new species. Epigynum. 153. *Tapinocyba* (?) *gamma* new species. Epigynum. 154. *Tapinocyba alpha* new species. Epigynum. 155. *Tapinocyba alpha* new species. ♂ palpus (holotype).


147
148
150
149
151
154
152
155
153

Coloncus americanus (Chamberlin and Ivie), new combination

Fig. 51

Araenocus americanus Chamberlin and Ivie, 1944, Bull. Univ. Utah, Biol. Ser. 8(5): 58; *110. ♀.

Type locality.—GEORGIA: Bell to Washington; April 30, 1943, W. Ivie, ♀ holotype (Chamberlin & Ivie, 1944).

Coloncus cascadeus, new species

Female.—Carapace dull yellow with the usual dusky markings. Legs yellow without markings. Chelicerae dull yellow, more or less dusky. Sternum nearly black. Abdomen black throughout excepting the epigynal area.

Clypeus protruding, of the usual height. Posterior row of eyes straight; the medians their diameter or slightly more apart, closer to the laterals. Anterior row of eyes slightly procurved; median eyes smaller than the laterals, nearer to each other than to the laterals. Quadrangle of median eyes wider behind than in front.

The epigynum of the typical general form, differing from that of *siou*, for example, in having the posterior expansion of the septum more deltoid in shape, with the lateral ends not rounded but acute.

Length, of ♀ holotype, 1.75 mm.; of ♂ allotype, 1.1 mm.

Type locality.—COLORADO: W. of Cascade. Holotype, ♂, allotype ♀, and 1 ♂ and 1 ♀ paratype taken June 22, 1940.

A somewhat smaller species than *C. siou*. As the specimens representing it came to light after the plate accompanying this article had been made, drawings of the copulatory organs had to be saved for future publication.

Coloncus ocala, new species

Fig. 50

Female.—Carapace light brownish, with the usual pattern of dusky markings. Chelicerae light reddish brown. Labium and endites dusky, with whitish tips. Sternum blackish. Legs and palpi light yellow, with some dusky markings on coxae. Abdomen dark gray, nearly black. Spinnerets dusky yellow.

Structure: Normal. Anterior eye row faintly procurved; a. m. eyes smaller than the others, 0.6 diameter apart, 0.9 diameter from side eyes. Posterior row faintly recurved; p. m. eyes 0.9 diameter apart, 0.7 diameter from the side eyes. Median ocular quadrangle wider behind than in front, very slightly wider than long. Epigynum of the typical general form, with differences of proportion.

Measurements:

	♀ *Holotype*	
	Mm.	*Ratio*
Length	1.65	220
Cephalothorax:		
Length	0.75	100
Width	0.55	73
Tibia-patella:		
1	0.64	85
4	0.73	97

Type locality.—FLORIDA: Ocala Forest, (W. 81° 43′ : N. 29° 10′), June 13, 1935. ♀ holotype taken June 13, 1935.

Other records.—FLORIDA: Gainesville, 2 ♀ ♀ taken Feb. 10, 1942.

Coloncus pius, new species

Fig. 52

Carapace brown, with the usual pattern of dusky markings. Chelicerae brownish, lighter distally and mesally. Labium and endites dusky brown, with light tips. Sternum blackish. Legs orange, lightly marked with dusky at the joints and on the coxae. Palpi more brownish. Abdomen blackish. Epigynum and spinnerets dusky brown.

Structure: Essentially normal. Larger than other known species. Clypeus slightly protruding, height about 3 diameters of an a. s. eye. Anterior eye row slightly procurved; a. m. eyes smaller than the laterals, about 0.5 diameter apart, about 1.2 diameters from side eyes. Posterior eye row straight; eyes equidistant, about 1.1 diameters apart. Median ocular quadrangle very slightly longer than wide, wider behind than in front. Chelicerae with file on ectal side; fang groove with four teeth in front and three behind. Epigynum of the usual form, close to that of *americana* and *wilsoni*, varying only in proportions and minor details.

Measurements:

	♀ *Holotype*	
	Mm.	*Ratio*
Length	2.60	260
Cephalothorax:		
Length	1.00	100
Width	0.70	70
Tibia-patella:		
1	0.86	86
4	1.00	100

Type locality.—IDAHO: 4 mi. N. E. McCall (W. 116° 4′ : N. 44° 55′). ♀ holotype taken May 31, 1944.

This species is superficially different from the others in the genus by its larger size and somewhat lighter coloring.

Coloncus siou, new species

Figs. 48, 49

Female.—Carapace brown with the usual pattern of dusky markings. Chelicerae brownish, paler distally and mesally. Labium and endites dusky brown, with light tips. Sternum shiny blackish brown. Legs and palpi light brownish yellow, lightly shaded with dusky, more so on the coxae, distal part of palpi more brown. Abdomen dark gray to black. Spinnerets and epigynum dusky brown.

Structure: Essentially normal. Clypeus slightly protruding, height about 3 diameters of an a. s. eye. Anterior eye row slightly procurved; a. m. eyes smaller than the side eyes, about 0.7 diameter apart, 1.0 diameter from side eyes. Posterior row straight; eyes equidistant, about 1.1 diameters apart. Median ocular quadrangle about as wide as long; wider behind than in front. Chelicerae normal; fang groove with four teeth on front margin, three small teeth on hind margin.

Sternum large, convex, shiny, as wide as long; broad posterior

extension separating hind coxae by more than a diameter of one of them. Legs and palpi normal. Epigynum typical in general form. It closely resembles that of *ocala*, except for small details; but the spider is distinctly larger.

Measurements:

	♀ *Holotype*	
	Mm.	*Ratio*
Length	2.00	250
Cephalothorax:		
Length	0.80	100
Width	0.66	82
Tibia-patella:		
1	0.77	97
4	0.88	110

Type locality.—NORTH DAKOTA: Hamlet (W. 103° 4′ : N. 48° 38′), ♀ holotype and ♀ paratype taken June 23, 1936 (Joe Davis collector).

Genus **Cornicularia** Menge, 1868

Preussische Spinnen, 226.

Generotype: *Cornicularia unicornis* Cambridge.

Cornicularia selma, new species

Fig. 53

Female.—Carapace yellowish brown, lightly marked with dusky; eyes on black spots. Chelicerae and endites light reddish brown. Sternum and labium dusky brown, darker around the edges. Legs and palpi brownish yellow. Abdomen blackish. Spinnerets light brownish yellow. Epigynum brownish-yellow and dusky.

Size medium to small. Carapace normal; back of head slightly convex. Height of clypeus about 2 diameters anterior side eyes. Eye area occupies little more than 0.7 width of head; anterior median eyes smaller than the others. Posterior eye row faintly recurved; posterior median eyes 0.9 diameter apart, 0.7 diameter from side eyes. Anterior row about straight; anterior median eyes about 0.4 diameter apart, 0.9 diameter from side eyes. Median ocular quadrangle slightly longer than wide, much wider behind than in front.

Chelicerae slightly reclined; stridulating file distinct; fang groove with five teeth in front, three behind. Sternum normal; separates hind coxae by about a diameter. Legs moderately short. Abdomen normal; epigastric plates with stridulating file.

Epigynum with a wide, somewhat triangular posterior sclerite as seen from ventral view; spermathecae and tubes visible.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.50	214
Cephalothorax:		
Length	0.70	100
Width	0.51	73
Tibia-patella:		
1	0.53	76
4	0.62	89

Type locality.—OREGON: Selma, April 6, 1937, J. C. Chamberlin, 2 ♀.

Genus **Corypheolana** Strand, 1914

Generotype: *Corypheolana holmgreni* (Thorell).

Corypheolana oatimpa, new species

Fig. 161

Carapace dusky to nearly black over yellow or light brown, the head above and anteriorly lighter; a fine median black line running forward to between the median eyes; a light spot on each side of middle line of head behind. Legs yellow; coxae and trochanters black in a line across distal end beneath. Sternum dusky to nearly solid black. Abdomen black throughout excepting the epigynum and spinnerets.

Posterior row of eyes straight or slightly procurved; medians about their diameter apart, slightly closer to the laterals. Quadrangle of median eyes longer than wide, narrower in front than behind. Anterior row of eyes definitely recurved; medians subcontiguous, a little farther from the laterals.

Epigynum as drawn (fig. 161).

Length of ♀, 2.4 mm.

Type locality.—WYOMING: Yellowstone Lake, Bridge Bay. Several ♀ ♀ taken June 20, 1938.

Genus **Disembolus** Chamberlin and Ivie, 1933

Bull. Univ. Utah, Biol. Ser., 2(2): 20–22.

Orthotype: *Disembolus stridulans* Chamberlin and Ivie.

Disembolus apache, new species

Fig. 163

Carapace dusky orange. Legs clear yellow. Sternum dusky over orange. Endites yellow and labium dusky or black. Abdomen throughout orange.

Posterior row of eyes recurved; median eye about their radius apart and twice as far from the laterals. Quadrangle of median eyes narrower in front than behind. Anterior row of eyes also a little recurved; medians very small, much closer to each other than to the laterals.

Epigynum as drawn (fig. 163).

Length, 2 mm.

Type locality.—ARIZONA: Willow Creek, near Birchell's Ranch (?). One ♀ taken in October, 1928.

The type is faded from long preservation and markings are no longer evident. The species seems clearly distinct in the form of the epigynum which has the general features of that of *D. stridulans* C. and I.; but the median septum is notably broader, the cross arms mesally thicker in the antero-caudal direction, etc.

Disembolus zygethus, new species

Figs. 42, 43

Female.—Color: Carapace yellowish brown; with dusky markings of the usual pattern. Chelicerae medium brown. Endites orange brown with lighter tips. Sternum and labium dusky brown. Legs yellowish with femora and tibia darkened; tarsi and metatarsi pale. Palpi light

yellowish brown. Abdomen dark gray. Spinnerets light brownish yellow. Epigynum brownish and yellowish.

Structure: Size moderately large. Carapace normal in outline, slightly elongate; cervical indentations extended over back of head, causing a depression in the profile; head narrowed and slightly convex back of eyes; median groove very narrow, indistinct. Clypeus nearly vertical, height about 3 diameters of a. s. eye. Eye area occupies about 0.7 width of head. Posterior row faintly procurved; p. m. eyes 0.8 diameter apart, 0.7 diameter from side eyes. Anterior row slightly recurved; a. m. eyes 0.3 diameter apart, 0.4 diameter from side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae vertical; stridulating file coarse; fang groove with four large, widely spaced teeth behind, none in front. Sternum pointed behind, separates hind coxae by less than a diameter. Palpi moderately large, swollen on tibia and tarsus, especially at the joint between the two. Legs moderately stout. Epigynum moderately large; with a large, transverse posterior plate, which is deeply concave in the anterior middle, enclosing a pale extension from in front; openings are a pair of narrow slits between the posterior plate and the anterior extension.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.85	248
Cephalothorax:		
Length	1.15	100
Width	0.80	70
Tibia-patella:		
1	1.00	87
4	1.20	104

Type locality.—IDAHO: North end Payette Lake, July 4, 1943, ♀, W. Ivie.

Genus **Eperigone** Crosby and Bishop, 1928

N. Y. State Mus. Bull., 27: 46.

Generotype: *Eperigone trilobatus* (Emerton).

Eperigone socius, new species

Fig. 159

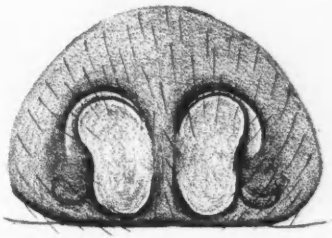
Carapace light brown, dusky, with the usual darker radiating lines. Legs dull yellow. Sternum weakly dusky over a yellowish background. Labium also dusky. Abdomen black throughout.

Distinguishable from other species in the form of the epigynum which is represented in fig. 159.

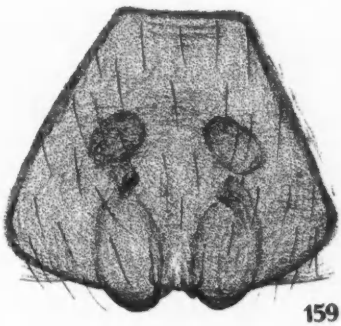
EXPLANATION OF PLATE XV

156. *Tapinocyba alpha* new species. Tibia of left ♂ palpus, ectodorsal view. 157. *Ceraticelus agathus* new species. Epigynum. 158. *Ceraticelus albus* (W. Fox). Epigynum. 159. *Eperigone socius* new species. Epigynum. 160. *Tigellinus weber* new species. Epigynum. 161. *Corypheolana oatimpa* new species. Epigynum. 162. *Maso navajo* new species. Epigynum. 163. *Disembolus apache* new species. Epigynum.

156

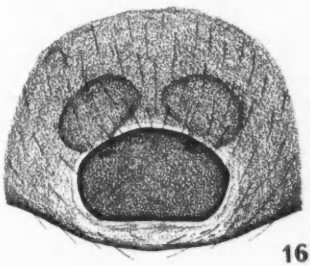


163

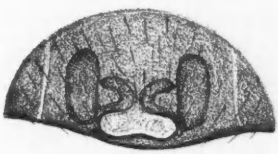


159

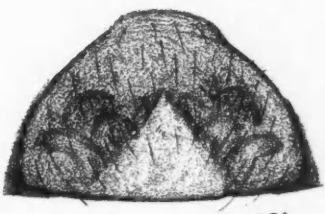
157



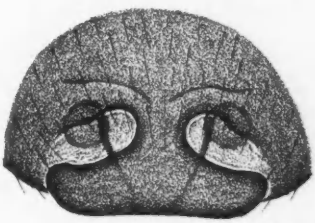
160



158



161



162

Length of ♀ holotype, 2.2 mm.

Type locality.—WYOMING: Bridge Bay, Yellowstone Lake, ♀ holotype taken June 20, 1938.

From *E. holda* Chamberlin and Ivie, occurring in the same region, distinguishable in the different form of the epigynum.

Genus **Eularia** Chamberlin and Ivie, 1933

Bull. Univ. Utah, Biol. Ser., 2(2): 14.

Orthotype: *Eulaira dela* Chamberlin and Ivie.

Eularia kaiba, new species

Figs. 59, 60

Female.—Color: Carapace light brownish yellow, with faint dusky markings; eyes on black spots. Chelicerae and endites brownish orange. Sternum and labium dark dusky yellow. Palpi and legs light brownish yellow. Abdomen dark gray. Spinnerets light brownish yellow. Epigynum yellowish brown and dusky. Epigastric plates yellowish.

Structure: Size medium. Carapace normal; head moderately narrowed. Height of clypeus about 1.7 diameters of a. s. eye. Eye area occupies about three-fourths width of head. Eyes moderately large; a. m. eyes much smaller than the others. Posterior eye row straight to faintly procurved; p. m. eyes about 0.7 diameter apart, about 0.6 diameter from the side eyes. Anterior row straight to slightly recurved. A. m. eyes about 0.6 diameter apart, about 0.4 diameter from the side eyes. Median ocular quadrangle a little longer than wide, wider behind than in front.

Chelicerae slightly reclined; fang groove with five large teeth in front, five small teeth behind. Sternum, legs and abdomen normal. Epigynum very simple, consisting of a pair of small inconspicuous openings, widely separated.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.85	218
Cephalothorax:		
Length	0.85	100
Width	0.68	80
Tibia-patella:		
1	0.75	88
4	0.85	100

Type locality.—UTAH: Mirror Lake, Uintah Mts., July 28, 1936, ♀.

Eularia wioma, new species

Female.—Color: Carapace light brownish yellow, lightly touched with dusky. Chelicerae and endites orange. Sternum and labium dusky yellow. Legs and palpi light yellowish. Abdomen pale gray. Spinnerets yellowish. Epigynum yellowish and dusky.

Structure: Size medium to small. Structure essentially normal. Head slightly convex back of eyes. Height of clypeus about 1.7 diameters of a. s. eye. Eye area occupies about 0.6 width of head.

A. m. eyes much smaller than the others. Posterior row straight; eyes about 0.7 diameter apart. Anterior row straight; a. m. eyes about 0.5 diameter apart, about same distance from side eyes. Median ocular quadrangle a little longer than wide, wider behind than in front. Chelicerae slightly reclined; fang groove with three teeth in front, four tiny teeth behind. Epigynum simple, with opening concealed from ventral view.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.65	220
Cephalothorax:		
Length	0.75	100
Width	0.55	73
Tibia-patella:		
1	0.62	83
2	....	....

Type locality.—WYOMING: Bridge Bay, Yellowstone Lake; August 11, 1940, ♀.

Eularia quaestio, new species

Figs. 57, 58

Female.—Color: Carapace light brown, with the usual pattern of dusky markings. Chelicerae yellowish brown. Sternum, labium, and endites dusky. Legs and palpi light brown, lightly shaded with dusky. Abdomen dark gray. Spinnerets and epigynum dusky brown.

Structure: Size small. Structure essentially normal. Height of clypeus about 1.6 to 2.0 diameters of a. s. eye. Eye area occupying more than two-thirds width of head. Posterior eye row straight; p. m. eyes 0.9 diameter apart, 0.8 diameter from side eyes. Anterior row straight; a. m. eyes 0.4 diameter apart, 0.5 diameter from side eyes. Chelicerae vertical; fang groove with four or five small teeth in front, five tiny denticles behind. Sternum normal, separating hind coxae by a full diameter. Legs moderately short. Epigynum small, produced behind into a short, blunt point; openings consist of a pair of narrow longitudinal slits on the dorsal side.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.50	231
Cephalothorax:		
Length	0.65	100
Width	0.50	77
Tibia-patella:		
1	0.55	85
4	0.60	92

Type locality.—MANITOBA: Churchill, June-July, 1936, 3 ♀, H. E. McClure.

Genus **Grammonota** Emerton, 1882

Trans. Conn. Acad. Sci., 6: 38.

Generotype: *Grammonota pictilis* (Cambridge).

Grammonota (?) salicicola, new species

Fig. 61

Female.—Color: Carapace brownish yellow, with distinct and rather heavy dusky markings. Chelicerae and endites light reddish brown. Sternum dusky, faded to yellowish in the middle; labium dusky. Legs and palpi bright yellow. Spinnerets yellow. Epigynum yellowish and dusky brown.

Structure: Size medium to small. Carapace broadly truncate behind; head moderately narrowed and slightly elevated. Height of clypeus about 2.3 diameters of a. s. eyes. Eye area occupies about 0.7 width of head. A. m. eyes much smaller than the others. Posterior eye row procurved, p. m. eyes about 1.0 diameter apart, 0.6 diameter from side eyes. Anterior row slightly procurved; a. m. eyes about 0.5 diameter apart, same distance from side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae slightly reclined; fang groove with five teeth in front, four small teeth behind. Sternum large, convex; separates hind coxae by nearly a length. Legs and palpi normal. Abdomen large, broad and slightly flattened. Epigynum with a simple sub-quadrate depression behind somewhat as in a typical *Grammonota*.

Measurements:

♀	*Mm.*	*Ratio*
Length	1.60	246
Cephalothorax:		
Length	0.65	100
Width	0.54	83
Tibia-patella;		
1	0.62	95
4	0.72	111

Type locality.—UTAH: Southwest of Salt Lake City, May 16, 1941, ♀, W. Ivie.

Genus **Hilaira** Simon, 1884

Arachnides de France, 5(2): 374.

Generotype: *Hilaria excisa* (Cambridge).

Hilaira garrina, new species

Figs. 63–68

Male, female.—Color: Carapace light brown, faintly marked with dusky. Chelicerae light reddish brown. Endites brownish orange. Labium and sternum dusky over yellow. Legs and palpi brownish yellow. Abdomen dark gray. Spinnerets yellowish.

Structure: Size moderately large; body somewhat elongate. Carapace moderately broad and flat; head slightly elevated and rounded, more so in the male. Eyes small; area occupying about three-fifths width of head. Anterior row slightly recurved; p. m. eyes about 0.3 diameter apart, about 1.0 diameter from larger side eyes. Posterior row straight or faintly procurved; p. m. eyes 1.0 diameter apart, 1.2 diameter from side eyes. Median ocular quadrangle about as wide as

long, wider behind than in front. Height of clypeus about 3.0 diameters of an a. m. eye in female, about 3.5 diameters in male.

Chelicerae vertical, moderately stout; fang groove with five large teeth in front, three or four teeth behind. Legs normal; 4, 1, 2, 3, in order of length; hind tibia with one seta above. Abdomen somewhat elongate. Epigynum small. Palpus of average size (details shown in figures).

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	2.82	207	3.40	250
Cephalothorax:				
Length	1.36	100	1.36	100
Width	1.09	80	1.06	78
Tibia-patella:				
1	1.27	93	1.27	93
4	1.36	100	1.38	101

Type locality.—COLORADO: Pike's Peak (about 13,700 ft.), June 22, 1940, ♂ holotype, ♀ allotype, ♂ ♀ paratypes, W. Ivie and A. L. Wilson collectors. Found under pieces of granite.

Close to *H. tatrica* Kulc.

Genus **Lophomma** Menge, 1867

Schr. Naturf. Ges. Danzig (N. F.) 2(1): 209.

Generotype: *Lophomma punctata* (Blackwall).

Lophomma columbia, new species

Figs. 71–76

Male, female.—Color: Carapace light brown, faintly marked with dusky. Chelicerae light brown. Endites pale orange brown, lighter at the tips. Sternum and labium dusky brown. Legs and palpi pale brown, palpal organs darker. Abdomen gray. Spinnerets light brown. Epigynum light yellowish brown and dusky.

Structure: Size medium. Male head and clypeus modified; carapace otherwise normal. Clypeus broad, rounded, protruding; height more than four times diameter of a. s. eye. Head with large central part highly elevated into a rounded lobe; a large oval pit back of each p. e. eye. Posterior eye row slightly procurved; p. m. eyes situated near top of hump, near front, about 1.5 diameters apart, nearly 4 diameters from lateral eyes. Anterior row strongly procurved; a. m. eyes small, located on front of hump, about 0.5 diameter apart, more than 4 diameters from a. s. eyes. Lateral eyes below and to the front of the cephalic hump. Median ocular quadrangle wider than long, much wider behind than in front. Chelicerae vertical; stridulating file distinct; fang groove with four large teeth in front, three or four small teeth behind. Sternum moderately large, with intercoxal points; hind coxae separated by slightly less than a diameter. Legs moderately long; tarsi longer than usual, slender. Abdomen normal; epigastric plates provided with a prominent stridulating file (the pick is on the posterior distal margin of coxae 4). Palpus of medium size. Femur

short. Patella long, nearly three times as long as wide, smooth on top. Tibia short and narrowed, slightly longer than wide, with a short angular projection above. Tarsus bent at nearly a right angle to the tibia. Cymbium with a conical projection at base above, which bears a cluster of stout spines; with a blunt projection toward distal end on ectal edge. A distal process arises back of the embolic division at distal end, divided into a stout spine and a broad lamella. Embolic division with tail-piece and middle part tightly twisted; embolus moderately long and slender, curved into a semi-circle.

Female.—Carapace slightly elongate, head moderately wide; clypeus rounded across front, height about 4 diameters of a. s. eye. Eye area occupies about 0.7 width of head. Posterior eye row straight; p. m. eyes about 1.3 diameters apart, 1.1 diameters from side eyes. Anterior row faintly procurved; a. m. eyes about 0.4 diameter apart, 1.9 diameters from side eyes. Chelicerae vertical; fang groove with five teeth in front, four small teeth behind. Both chelicerae and epigastic plates have stridulating files, but not as prominently as in the male. Legs long. Epigynum with a large posterior sclerite, which appears broad behind, from ventral view, but much narrower in front; openings small, widely separated.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.75	219	1.75	219
Cephalothorax:				
Length	0.80	100	0.80	100
Width	0.60	75	0.60	75
Tibia-patella:				
1	0.80	100	0.80	100
4	0.87	109	0.90	112

Type locality.—BRITISH COLUMBIA: W. side Seanich Inlet, Sept. 14, 1945, ♂♂ ♀♀, Chamberlin and Ivie; L. Cameron, V. I., Sept. 13, 1935. Chamberlin and Ivie.

Genus **Maso** Simon, 1884

Arachnides de France, 5(3): 861.

Generotype: *Maso sundvalli* (Westring).

Maso marxi matanuskae, new variety

Maso sundevalli (Westr.), Chamberlin and Ivie, 1947.

Female.—Color: Carapace brown, lightly marked with dusky. Chelicerae light brown. Endites light brown with whitish tips. Sternum and labium dark dusky brown. Legs and palpi bright yellowish-orange. Abdomen dark gray above; light gray on sides and venter, darker around spinnerets. Spinnerets light brown. Epigynum dusky brown.

Structure: Size medium. Carapace ovoid, head rather narrow; median groove absent. Clypeus nearly vertical; height about 2.0 diameters of a. s. eye. Eye area occupies about 0.8 width of head; a. s. eye large, raised on tubercles. Anterior eye row slightly longer than posterior row; slightly procurved; a. m. eye small; about 0.5 diameter apart, about 2.0 diameters from side eye. Posterior row

slightly recurved; p. m. eye a 1.0 diameter apart, 0.9 diameter from side eye. Median ocular quadrangle slightly longer than wide, wider behind.

Chelicerae vertical; fang groove with four teeth in front, three small teeth behind. Sternum large, convex, as wide as long, truncate behind; separates hind coxae by more than a diameter. Legs moderately short and stout; tarsi much shorter than metatarsi. Epigynum moderately large; has two large openings beneath a raised ridge, separated by a narrow-septum.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.72	236
Cephalothorax:		
Length	0.73	100
Width	0.60	82
Tibia-patella:		
1	0.67	92
4	0.70	96

Type locality.—ALASKA: Matanuska, Sept., 1944, ♀, J. C. Chamberlin.

Close to *M. sundevalli* (W.), but the anterior lateral eyes are more protruding.

Maso navajo, new species

Fig. 162

Carapace dull yellow, a few long black setae in series along mid-dorsal line. Legs clear yellow. Sternum dusky over light orange. Endites yellow. Labium dusky. Abdomen entirely light grey or nearly white.

Posterior row of eyes straight; median eyes not fully their diameter apart, a little farther from the laterals; slightly longer than the anterior row. Quadrangle of median eyes narrower in front than behind and a little longer than wide. Anterior row of eyes distinctly procurved; median eyes relatively small, nearly contiguous with each other, but separated by about their radius from the laterals. Anterior margin of furrow of chelicera with five teeth of which the most proximal is more remote; teeth of posterior margin small, three or four in number.

Epigynum as drawn (fig. 162).

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.20	275
Cephalothorax:		
Length	0.80	100
Width	0.70	85
Tibia-patella:		
4	0.10	125

Type locality.—ARIZONA: At a creek 8 mi. N. of Roosevelt Dam, ♀, April 11, 1935, Wilton Ivie.

Aside from differences in color, this species is distinguishable from the preceding and others in the form of the epigynum.

Genus **Masoncus,** new

The males in this genus have cephalic pits. The embolic division of the male palpus straight, distally bifid, the embolus proper short and straight, the other branch typically geniculate. Epigynum of the characteristic structure shown in the figures for the several species.

Generotype: *Masoncus arienus* new species.

Masoncus dux, new species

Fig. 103

Female.—Color: Carapace light brown. Chelicerae reddish brown. Endites orange brown. Sternum and labium light dusky brown. Legs and palpi yellowish brown. Abdomen black. Spinnerets dusky brown. Epigynum reddish brown and dusky.

Structure: Size a little above medium, moderately stout. Carapace broad oval. Head broad, rounded. Clypeus slightly protruding; height nearly 3 diameters of a. s. eye. Eye area occupying slightly more than half the width of the head. Posterior eye row procurved; p. m. eyes 1.2 diameters apart, 1.1 diameters from side eyes. Anterior row slightly recurved; a. m. eyes 0.3 diameter apart; 1.0 diameter from side eyes. Median ocular quadrangle a little longer than wide, a little wider behind than in front. Chelicerae vertical, stout; fang groove with five large teeth in front, two small teeth behind. Sternum broad, obtusely pointed behind, separating hind coxae by much less than a diameter. Legs moderately stout. Epigynum cavernous.

Measurements:

♀	*Mm.*	*Ratio*
Length	2.25	188
Cephalothorax:		
Length	1.20	100
Width	0.95	79
Tibia-patella:		
1	1.07	89
4	....	....

Type locality.—MANITOBA: Churchill, June-July, 1936, ♀, H. E. McClure.

Masoncus arienus, new species

Figs. 99–102

Male, female.—Color: Carapace light brownish orange; eyes on black spots. Chelicerae light orange brown. Endites and labium yellowish orange. Sternum orange yellow. Legs and palpi light brownish yellow. Abdomen pale gray. Spinnerets pale yellow.

Structure: Size medium to large. Cephalic pits opening just back of the p. s. eye; the pits not extending under the p. m. eyes; head not otherwise modified. Height of clypeus about 2.7 diameters of an a. s. eye. Eye area occupies about 0.6 width of head. Posterior eye row slightly procurved; p. m. eyes about 0.9 diameter apart, 0.7 diameter from side eyes. Anterior row slightly procurved; a. m. eyes about 0.3 diameter apart, 0.4 diameter from side eyes. Median ocular quadrangle slightly wider than long, a little wider behind than in front.

Chelicerae vertical, moderately stout, slightly inflated especially near base; a spur on front toward distal end; fang groove with a small setigerous nodule in front, nine or ten teeth behind in two linear, and nearly consecutive, series, probably resulting from a migration of the anterior teeth to the rear. Endites with a small spur on ectal side of tip. Sternum large, convex; hind coxae separated by a little more than a diameter. Legs moderately long.

Palpus small. Patella normal. Tibia with two short, blunt, black processes on distal border above. Cymbium normal. Embolic division about as long as the tarsus, twisted but not coiled; tailpiece reduced in size.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	2.25	225	2.65	273
Cephalothorax:				
Length	1.00	100	0.97	100
Width	0.80	80	0.75	77
Tibia-patella:				
1	1.00	100	0.95	98
4	....	....	....	....

Type locality.—ARIZONA: Covered Wells, January 3, 1941, ♂, D. and S. Mulaik.

Other records.—ARIZONA: 12 mi. W. Robes, January 2, 1941, 2 ♂ ♀, D. and S. Mulaik.

Masoncus nogales, new species

Figs. 93–98

Color: Carapace uniform orange yellow, with interocular area more or less dusky. Chelicerae light orange brown. Endites orange. Sternum orange yellow; labium darker. Legs and palpi yellow, with palpal organs of male darker. Abdomen pale gray. Spinnerets yellow. Epigynum brown and dusky.

Structure: Size a little above medium. General structure slightly elongate. Carapace elongate oval. Head slightly raised. Height of clypeus about 3 diameters of an a. s. eye. A short groove on each side of head, beginning between the posterior median and lateral eye; a small deep pit in the front end of the groove penetrating beneath p. m. eye. Head of female less elevated; height of clypeus 2 diameters of a. s. eye; head pits absent. Eye area occupying a little more than half the width of the head; a. m. eyes a little smaller than the others. Posterior row procurved; eyes 0.9 diameter apart. Anterior row procurved; eyes sub-contiguous. Lateral eyes of each side contiguous. Median ocular quadrangle about as wide as long; a little wider behind than in front. Chelicerae moderately stout, vertical, slightly convex in front; fang groove with six teeth in front, five behind; a small setigerous spur in front near distal end in male.

Sternum large, strongly convex; pointed behind, separating hind coxae by a scant diameter. Legs moderately long and slender. Male palpus small; embolic division short, with a spatulate tail-piece and with

two points distally, one partly curved around the other. Abdomen slightly elongate, pointed behind. Epigynum large and cavernous.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	2.10	226	2.20	244
Cephalothorax:				
Length	0.93	100	0.90	100
Width	0.75	81	0.67	74
Tibia-patella:				
1	0.97	104	0.93	103
4	0.97	104	0.93	103

Type locality.—ARIZONA: 11 mi. No. Nogales, December 31, 1940, 2 ♂ 4 ♀ (♀ holotype, ♂ allotype, D. and S. Mulaik Colls.). One male has palpus stunted, the other has the bulbus separated. TEXAS: Water Valley, December, 1939, ♀, D. and S. Mulaik.

Genus **Minyriolus** Simon, 1884

Arachnides de France, 5: 656.

Generotype: *Minyriolus pusillus* (Wider).

Minyriolus (?) plesius, new species

Male, female.—Color: Carapace dark brown, lightly marked with dusky. Chelicerae and endites brown, lighter distally. Sternum and labium dark dusky brown. Legs and palpi yellowish brown, lightly shaded with dusky in female; palpal organs darker brownish and dusky. Abdomen black. Spinnerets light brown. Epigynum dusky brown.

Structure: Size medium. Body stout; legs moderately stout.

Male.—Carapace ovoid, wide behind, narrow in front; head only slightly elevated; with a distinct pit back of each p. s. eye. Clypeus vertical; height nearly 4 diameters of a. s. eye. Eye area occupies about 0.8 width of head; a. m. eye a little smaller than the others. Posterior eye row procurved; p. m. eye about 1.0 diameter apart, 1.5 diameters from side eye. Anterior row slightly procurved; a. m. eye about 0.5 diameter apart, 1.2 diameters from side eye. Median ocular quadrangle much longer than wide, wider behind than in front. Chelicerae vertical; a light-colored swelling on anterior mesal side, toward distal end. Sternum broad, separates hind coxae by slightly more than a diameter. Legs and abdomen normal. Both sets of stridulating organs present. Palpus moderately large; tibia with a long stout process; ambolus long, coiled, stout at base, slender at tip.

Female.—Similar to male; except, head not modified, legs stouter. Abdomen larger. Carapace ovoid, as in male, but head slightly wider. Clypeus slightly protruding; height about 2.5 diameters of a. s. eye. Eye area occupies about 0.7 width of head; a. m. eye smaller than the others. Posterior eye row slightly procurved; p. m. eye 1.0 diameter apart, 0.9 diameter from side eye. Anterior row faintly procurved; a. m. eye about 0.5 diameter apart, 0.6 diameter from side eye. Median ocular quadrangle longer than wide, wider behind. Chelicerae reclined; fang groove with four teeth in front, three behind. Epigynum small, consisting mainly of a simple convex plate, with openings at the sides, and through which a pair of long, slender tubes are visible.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.75	219	1.90	224
Cephalothorax:				
Length	0.80	100	0.85	100
Width	0.70	88	0.70	82
Tibia-patella:				
1	0.75	94	0.75	88
4	0.80	100	0.82	96

Type locality.—WYOMING: Bridge Bay, Yellowstone Lake, June 20, 1938, ♂ 2 ♀.

Other record.—UTAH: Provo River at Cobble Rest Camp, July 30, 1936, 2 ♂, W. Ivie.

Minyriolus pampia, new species

Figs. 83–87

Male.—Color: Carapace brown, marked and shaded with blackish. Chelicerae dark brown. Sternum, labium and endites dark dusky brown. Legs and proximal segments of palpus light brownish yellow; distal part of palpus dusky brown. Abdomen black. Spinnerets brown.

Structure: Size moderately small. Carapace broad and rounded; head narrow, slightly elevated. Height of clypeus about 4 diameters of an a. s. eye. Eyes small. Posterior eye row slightly procurved; p. m. eyes 2.0 diameters apart, 2.5 diameters from side eyes. Anterior row about straight; a. m. eyes 1.0 diameter apart, 1.7 diameters from side eyes. Median ocular quadrangle decidedly longer than wide, wider behind than in front.

Chelicerae reclined. Sternum broad, separating hind coxae by about a length of one of them. Legs moderately short; tarsi 1 slightly inflated. Palpus moderately large. Tibia with a long dorsal process, with a bent tip. Embolus long and stout, with a semi-spiral tail-piece with a slender pointed process arising near the point of attachment and extending distally, and with a broad, flat attachment near the tip.

Measurements:

	♂	
	Mm.	*Ratio*
Length	1.35	200
Cephalothorax:		
Length	0.68	100
Width	0.63	93
Tibia-patella:		
1	0.60	88
4	0.70	103

Type locality.—NORTHWEST TERRITORY, CANADA: River Clyde, Baffin Island, June 2, 1945, ♂, Jack P. Woolstenhulme.

Genus **Montilaira** Chamberlin, 1921

J. New York Ent. Soc., 29: 40.

Orthotype: *Montilaria uta* (Chamberlin).

Montilaria relicta, new species

Figs. 69–70

Female.—Color: Carapace yellowish brown, lightly shaded and marked with dusky. Chelicerae and endites orange. Sternum and labium dusky brown. Legs and palpi yellowish orange. Abdomen dark gray. Spinnerets orange.

Structure: Size large. Structure essentially normal. Eye area occupying more than two-thirds the width of the head. Eyes moderately small; a. m. eyes a little smaller than the others. Posterior eye row faintly recurved; p. m. eyes about 1.0 diameter apart, 0.7 diameter from side eyes. Anterior row straight; a. m. eyes 0.5 diameter apart, 0.5 diameter from side eyes. Height of clypeus about 2.5 of a. s. eye.

Chelicerae moderately stout; fang groove with five teeth in front, four teeth behind near base of fang, of which the mesal is the largest and the others tiny. Stridulating file prominent. Legs moderately long and stout. Epigynum simple; openings concealed from ventral view.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.50	236
Cephalothorax:		
Length	1.10	100
Width	0.80	73
Tibia-patella:		
1	1.20	109
4	1.25	114

Type locality.—VERMONT: Mt. Mansfield, June 14, 1927, ♀, R. V. Chamberlin.

Genus **Oedothorax** Bertkan, 1883

Verh. naturf. Ver. preus. Rheinlande u. Westfalens, 40: 228.

Generotype: *Oedothorax gibbosus.*

Oedothorax cascadeus, new species

Figs. 77, 78

Female.—Color: Carapace light brown, distinctly marked with dusky in the usual pattern; a blackish mark extending of a. m. eyes nearly to edge of clypeus. Chelicerae light brown. Endites light dusky brown. Sternum and labium dark dusky brown. Legs and palpi light brown. Abdomen dark gray. Spinnerets dusky brown. Epigynum dusky brown.

Structure: Size medium; body slightly elongate. Carapace essentially normal, slightly elongate. Height of clypeus about 2.5 diameters of a. s. eye. Eye area occupies about 0.7 width of head; a. m. eyes only a little smaller than the others. Posterior eye row straight; p. m. eyes 1.0 diameter apart, 0.9 diameter from side eyes. Anterior row straight; a. m. eyes 0.4 diameter apart, 0.4 diameter from side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae vertical; fang groove with five teeth in front, five small teeth behind. Sternum normal, separates hind coxae by about a diameter. Legs normal length, moderately stout. Abdomen somewhat elongate. Epigynum moderately small; resembles epigynum of *O. trilobatus* in general appearance.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.80	240
Cephalothorax:		
Length	0.75	100
Width	0.55	73
Tibia-patella:		
1	0.62	83
4	0.73	97

Type locality.—IDAHO: Cascade, July 5, 1943, ♀, W. Ivie.

Genus **Pselothorax,** new

Cephalothorax greatly elevated and shaped like a truncated cone; conspicuously depressed or pitted above, with a sharply impressed curved furrow in the depression setting off the head posteriorly, the head not otherwise definitely set off from the thorax. Posterior row of eyes slightly procurved, the anterior row straight, the two lateral eyes on each side contiguous. Bulb of male palpus with a well developed embolus which terminates at the distal end of the terminal lobe of the bulb; tibia very short, flaring in cup-like form, without apophysis. Abdomen high and proportionately short. Tibia of fourth legs lacking spines.

Orthotype: *Pselothorax atopus*, new species.

Pselothorax atopus, new species

Cephalothorax dusky over yellow; legs brownish yellow. Abdomen dusky brown, above marked with six pairs of transversely elongate light spots and two transverse light lines between the last pair of these and the spinnerets; spinnerets yellow; area in front of genital furrow enclosed by a light colored line; behind the furrow on each side a longitudinal light line.

Clypeus very high. Anterior median eyes separated by a diameter of one of them, or a little more, each contiguous or nearly so with the lateral eye. Posterior median eyes somewhat less than their diameter apart, each a little farther from the lateral. Length, 2.5 mm.

Type locality.—UTAH: Salt Lake County, at mouth of Red Butte Canyon. One male taken in sifting leaves by Kathleen Lafferty.

Genus **Sciastes** Crosby, 1938

Jour. New York Ent. Soc., 46: 75.

Orthotype: *Sciastes truncatus* (Emerton).

Sciastes tenna, new species

Fig. 79

Female.—Color: Carapace brown, with a pair of longitudinal lighter spots on back of head. Chelicerae and endites orange brown. Sternum

and labium light dusky brown. Legs and palpi orange brown. Abdomen dark gray. Spinnerets light orange. Epigynum dusky orange.

Structure: Size medium. Eyes protruding slightly over clypeus. Eyes occupying a little more than half the width of the head. Posterior eye row recurved. P. m. eyes about 1.0 diameter apart, 0.9 diameter from larger side eyes. Anterior row straight; a. m. eyes 0.4 diameter apart, 0.5 diameter from much larger side eyes. Median ocular quadrangle much wider behind than in front, about as wide behind as long. Height of clypeus about 3.0 diameters of an a. s. eye.

Chelicerae slightly reclined; fang groove with five teeth in front, three behind. Sternum separating hind coxae by a diameter of one of them. Palpus somewhat enlarged in the tibia and tarsus. Epigynum extended slightly behind, concealing single large opening beneath.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.85	195
Cephalothorax:		
Length	0.95	100
Width	0.75	79
Tibia-patella:		
1	0.75	79
4	0.77	81

Type locality.—TENNESSEE: Little Pegion Creek, Great Smoky Mts., July 9, 1933, W. Ivie.

Genus **Scironis** Crosby, 1938

Jour. New York Ent. Soc., 46: 72.

Orthotype: *Scironis tarsalis* (Emerton).

Scironis autor, new species

Fig. 104

Female.—Color: Carapace yellowish brown, with sides of head a little darker; eyes on small black spots. Chelicerae orange brown. Endites pale orange brown. Sternum and labium yellowish, lightly shaded with dusky. Legs and palpi light brownish orange. Abdomen pale yellowish gray. Spinnerets light yellowish. Epigynum yellowish, reddish brown, and dusky.

Structure: Size medium. Carapace moderately large, head slightly large, rounded, highest near middle; median groove absent. Clypeus light, smooth, slightly protruding; height about 4 diameters of a. s. eye. Eyes small; eye area occupies between 0.6 and 0.7 width of head. Posterior eye row slightly recurved; p. m. eyes about 2.0 diameters apart, 2.6 diameters from s. e. Anterior row slightly recurved; a. m. eyes about 0.5 diameter apart, 2.0 diameters from the side eyes. Median ocular quadrangle slightly wider than long, wider behind than in front.

Chelicerae vertical, moderately stout; stridulating file weak, but distinct, fang groove with five teeth in front, four small teeth behind. Sternum normal, separates hind coxae by about a diameter. Legs long. Abdomen normal; epigastric plates with a weak stridulating file.

Epigynum with a broad transverse lobe, hollowed out in middle and front, as usual; anterior pits absent.

Measurements:

	♀ *Mm.*	*Ratio*
Length	1.95	209
Cephalothorax:		
Length	0.93	100
Width	0.70	75
Tibia-patella:		
1	0.95	102
4	1.00	107

Type locality.—CALIFORNIA: Guernsey Cr., Sept. 7, 1935, ♀, R. V. Chamberlin and W. Ivie.

Scironis sima, new species

Figs. 105, 106

Male.—Color: Carapace light brownish yellow; eyes narrowly ringed with black. Chelicerae light orange brown. Endites, sternum, legs and palpi light yellowish; palpal organs darker. Labium light dusky yellow. Abdomen pale grayish yellow. Spinnerets light yellowish.

Structure: Size medium to small. Carapace essentially normal, head not modified, rounded; median groove absent. Clypeus slightly protruding; height about 4 diameters a. s. eye. Eyes small; eye area occupies about 0.5 width of head. Posterior eye row slightly procurved; p. m. eye about 1.5 diameters apart, 1.0 diameter from side eyes. Anterior row straight; a. m. eyes about 0.5 diameter apart, 0.8 diameter from side eyes. Median ocular quadrangle wider than long, much wider behind than in front.

Chelicerae vertical, normal; ectal side smooth, stridulating file apparently absent; fang groove with four teeth in front. Sternum moderately large, convex; separates hind coxae by 1.5 diameters. Legs moderately weak. Abdomen normal. Femur normal. Patella normal, a little longer than wide. Tibia wider than long, spread out distally with a conical process on dorsal rim. Tarsus enlarged, somewhat bell-shaped. Paracymbium moderately large, strongly hooked. Embolus long and coiled, making about one and a half large turns, stout at base, very slender distally; tail piece short, slightly curved in same direction as base of embolus, with a long, white, lash-like lamella.

Measurements:

	♂ *Mm.*	*Ratio*
Length	1.60	229
Cephalothorax:		
Length	0.70	100
Width	0.56	80
Tibia-patella:		
1	0.70	100
4	0.76	108

Type locality.—OREGON: Comstock, Sept. 9, 1935, ♂, R. V. Chamberlin and W. Ivie.

Genus **Scylaceus** Crosby, 1938

Jour. New York Ent. Soc., 46: 91.

Orthotype: *Scylaceus pallidus* (Emerton).

Scylaceus divisus, new species

Fig. 108

Female.—Color: Carapace yellowish, very lightly marked with dusky; eyes on black spots. Chelicerae yellowish brown. Endites light yellow. Sternum and labium yellow, shaded with dusky. Palpi and legs light yellow. Abdomen pale gray, shaded around spinnerets. Spinnerets pale yellow. Epigynum pale yellow, light brownish and dusky.

Structure: Size medium to small. Carapace normal. Clypeus slightly protruding; height a 3 diameters of a. s. eye. Eye area occupies about 0.6 width of head; a. m. eye much smaller than the others. Posterior eye row slightly recurved; p. m. eye 0.9 diameter apart, 0.7 diameter from side eye. Median ocular quadrangle slightly wider than long, much wider behind.

Chelicerae slightly reclined; stridulating file distinct; fang groove with five large teeth in front, five small teeth behind. Sternum normal. Legs moderately slender. Abdomen with stridulating files on epigastric plates. Epigynum with a large cross-piece behind, grooved along the middle and containing a small lobe in the posterior end of the groove; a large anterior lobe extending posteriorly.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.50	200
Cephalothorax:		
Length	0.75	100
Width	0.60	80
Tibia-patella:		
1	0.78	104
4	0.84	112

Type locality.—North Dakota: Divide Co., 1936–1938, ♀, Joe Davis.

Scylaceus amylus, new species

Fig. 107

Female.—Color: Carapace brownish-yellow; eyes on black spots. Chelicerae light brown. Endites light brownish orange. Sternum and labium yellowish, highly shaded with dusky. Abdomen pale gray, shaded with darker gray on dorsum, venter, and around spinnerets. Spinnerets yellowish. Epigynum yellowish, brownish and dusky.

Structure: Size small. Carapace normal; convex back of the eyes; without median groove. Clypeus slightly protruding; height about 2.2 diameters of a. s. eye. Eye area occupies about 0.5 width of head; a. m. eye much smaller than the others. Posterior eye row straight; p. m. eye 0.9 diameter apart, 0.6 diameter from side eye. Anterior row straight; eye subcontiguous. Median ocular quadrangle longer than wide, much wider behind than in front.

Chelicerae vertical; fang groove with four large teeth in front. Sternum moderately large; separates hind coxae by a little more than one diameter. Legs moderately short. Epigynum large, with a distinct rectangular cross piece behind and an obscure median septum.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.24	218
Cephalothorax:		
Length	0.57	100
Width	0.45	79
Tibia-patella:		
1	0.42	74
4	0.47	82

Type locality.—OHIO: Sugar Grove, August 3, 1935, ♀, Barrows and Ivie.

This species closely resembles *pallidus* in size, color, and structure, but differs considerably in the details of the epigynum.

Scylaceus pallas, new species

Female.—Color: Carapace, legs, palpi, sternum, labium, endites and spinnerets pale yellowish. Chelicerae brownish yellow. Abdomen pale grayish white. Epigynum yellowish brownish and dusky.

Structure: Size very small. Carapace normal, slightly elongate; without median groove. Clypeus slightly protruding; height about 2.0 diameters of a. s. eye. Eye area occupies between 0.6 and 0.7 width of head; a. m. eye much smaller than the others. Posterior eye row about straight, very slightly procurved; p. m. eye about 1.2 diameters apart, 0.8 diameter from side eye. Anterior row slightly recurved; a. m. eye about 0.4 diameter apart, 0.8 diameter from side eyes. Median ocular quadrangle about as wide as long, much wider behind.

Chelicerae vertical. Sternum large; hind coxae separated by more than a diameter. Legs with tarsi nearly as long as metatarsi. Epigynum with a small cross-piece behind, and with a long, rounded median ridge forming an inverted T with it; spermathecae and tubes conspicuous.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.00	208
Cephalothorax:		
Length	0.48	100
Width	0.36	75
Tibia-patella:		
1	0.37	77
4	....	....

Type locality.—ILLINOIS: Pallas Park, October 19, 1941, ♀, R. Wenzel.

This species is smaller and lighter in color than *pallidus*. It is more slender in the body, and there are minor differences in the eyes and epigynum.

Genus **Spirembolus** Chamberlin, 1920

Canad. Ent., 52: 197.

Orthotype: *Spirembolus monticolens* (Chamberlin).

Spirembolus cheronus, new species

Figs. 109, 110

Female.—Color: Carapace yellowish brown, lightly marked with dusky; interocular area largely black. Chelicerae and endites yellowish brown. Sternum and labium dusky over yellowish brown. Legs and palpi yellowish brown, end of femora ringed with dusky. Abdomen blackish. Spinnerets light brown. Epigynum dusky brown.

Structure: Size medium to small. Carapace normal, median groove absent. Clypeus vertical; height about 2.0 diameters of a. s. eye. Eye area occupies about 0.6 width of head; a. m. eyes smaller than the others. Posterior eye row straight; p. m. eyes about 1.0 diameter apart, about 0.9 diameter from side eye. Anterior row straight; a. m. eyes about 0.5 diameter apart, 0.6 diameter from side eye. Median ocular quadrangle slightly longer than wide; wider behind than in front.

Chelicerae vertical, stout; fang groove with five teeth in front; stridulating file present. Sternum normal; separates hind coxae by about a diameter. Legs moderately short; leg 4 much longer than leg 1. Epigynum simple; from ventral view, there is a pair of broad lateral lobes, raised at posterior edge, and narrowly separated in the middle, exposing the posterior sclerite, from posterior view, the lateral lobes each have a large opening on the posterior-mesal side, and the posterior sclerite is moderately small, somewhat longitudinally rectangular with rounded corners.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.95	222
Cephalothorax:		
Length	0.88	100
Width	0.65	74
Tibia-patella:		
1	0.64	73
4	0.75	83

Type locality.—WYOMING: Thumb, Yellowstone Park, June 23, 1938, ♀, W. Ivie.

Spirembolus oreinoides, new species

Fig. 41

Female.—Color: Carapace light brown, faintly marked with dusky. Chelicerae and endites light brown with pale tips. Sternum and labium dark dusky brown. Legs and palpi yellowish brown. Abdomen dark gray. Spinnerets light brownish yellow. Epigynum yellowish brown and dusky brown.

Structure: Size medium. General structure moderately robust. Carapace normal; head smoothly rounded except for the eyes. Height of clypeus about 3.5 diameters of a. s. eye at position of lateral eyes.

Eyes small; a. s. eyes slightly larger than the others. Eye area occupies about 0.6 width of head. Posterior eye faintly procurved; p. m. eyes 1.3 diameters apart, 1.2 diameters from side eyes. Anterior slightly recurved; a. m. eyes 0.3 diameter apart, 1.5 diameters from side eyes. Median ocular quadrangle about as long as wide, much wider behind than in front.

Chelicerae vertical; fang groove with five teeth in front (including a small nodule near base of fang) and five small teeth behind. Legs, sternum and abdomen normal. Epigynum of medium size.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.30	219
Cephalothorax:		
Length	1.05	100
Width	0.78	74
Tibia-patella:		
1	1.00	95
4	1.12	107

Type locality.—CALIFORNIA: Summit Mt. Palomar, July 26, 1931, ♀, R. V. Chamberlin and W. Ivie.

Spirembolus maderus, new species

Fig. 111

Female.—Color: Carapace yellowish brown, marked with dusky in the usual pattern; interocular area blackish. Chelicerae and endites light brown, lighter at the tips. Sternum and labium dusky over yellow. Legs and palpi yellowish brown, lighter at the joints. Abdomen dark gray. Spinnerets light brownish yellow. Epigynum brownish yellow and dusky.

Structure: Size small to medium. Carapace normal; dorsal profile slightly undulating. Clypeus slightly protruding; height a 3.0 diameter of a. s. eye. Eye area occupies a 0.6 width of head; a. m. eye a little smaller than the others. Posterior eye row straight; p. m. eye about 1.2 diameters apart, 0.8 diameters from side eye. Anterior row slightly procurved; a. m. eye about 0.3 diameter apart, 1.0 diameter from the side eye. Median ocular quadrangle about as long as wide, wider behind.

Chelicerae about vertical; stridulating file present; fang groove with five large teeth in front, five small teeth behind; a row of three small setigerous tubercles along mesal edge of each chelicerae in front. Sternum moderately large; separates hind coxae by about a diameter. Epigastric plates with a fine, but distinct, stridulating file; a distinct pick on coxae 4. Epigynum of the usual form.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.70	205
Cephalothorax:		
Length	0.83	100
Width	0.58	70
Tibia-patella:		
1	0.70	84
4	0.80	96

Type locality.—ARIZONA: Madera Canyon, Santa Rita Mts., September 8, 1941, ♀, W. Ivie.

Other records.—CALIFORNIA: Henshaw Dam, July 25, 1931, ♀, Chamberlin and Ivie; Irvine Park, near Santa Ana, July 17, 1931, ♀, Chamberlin and Ivie.

This may be the female of *S. spiratulus* (Banks).

Spirembolus orthus, new species

Fig. 112

Female.—Color: Carapace yellowish brown, lightly marked with dusky in the usual pattern. Chelicerae light brown. Endites pale brownish. Sternum and labium dusky over yellow. Legs and palpi light brown. Abdomen medium gray. Spinnerets light brown. Epigynum brownish yellow and dark brown.

Structure: Size small. Carapace normal; dorsal profile smooth. Clypeus slightly protruding; height about 2.5 diameters of a. s. eye. Eye area occupies about 0.6 width of head; a. m. eyes a little smaller than the others. Posterior eye row straight; p. m. eye about 1.0 diameter apart, 0.7 diameter from side eye. Anterior row straight, faintly procurved; a. m. eye about 0.3 diameter apart, 0.6 diameter from side eye. Median ocular quadrangle about as wide as long, wider behind than in front.

Abdomen with stridulating file on epigastric plates. Epigynum moderately small; with conspicuous spermathecae and with the usual cross-piece behind, which is extended forward in the middle as a short blunt septum.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.65	236
Cephalothorax:		
Length	0.70	100
Width	0.55	79
Tibia-patella:		
1	0.60	86
4	0.67	96

Type locality.—CALIFORNIA: W. side Owens Lake, August 6, 1931, ♀, W. Ivie.

This species closely resembles *S. whitneyana* Chamberlin and Ivie. The color appears to be a little lighter and the epigynum shows minor differences; principally, the median septum is more distinct and the lateral arms of the cross-piece, seen from ventral view, are a little longer and more slender.

Genus **Tachygyna** Chamberlin and Ivie, 1939

VII Intern. Kongress für Ent., p. 61.

Orthotype: *Tachygyna vancouverana* Chamberlin and Ivie.

Tachygyna paita, new species

Figs. 135, 136

Male.—Color: Carapace yellowish brown, marked with dusky in the usual pattern; interocular area dusky. Chelicerae brown, lighter

at distal end. Endites light dusky brown with light tips. Sternum and labium dark dusky over yellow. Legs and palpi light yellowish, palpal organs darker. Abdomen dark gray. Spinnerets light yellowish.

Structure: Size small. Carapace normal. Clypeus slightly protruding; height a 2.5 diameter of a. s. eye. A. m. eyes much smaller than the others; eye area occupies about 0.6 width of head. Posterior eye row faintly procurved; p. m. eye about 0.7 diameter apart, 0.6 diameter from side eye. Anterior row straight; a. m. eye about 0.3 diameter apart, 0.6 diameter from side eye. Median ocular quadrangle slightly longer than wide, wider behind than in front.

Chelicerae vertical, normal. Sternum large, convex, truncate behind; separates hind coxae by more than a diameter. Legs moderately short. Palpus of medium size; dorsal rim of tibia only slightly modified. Cymbium not modified. Paracymbium normal, moderately large. Embolic division with a short, broad, flat tail-piece; with a short spur at base of embolus; embolus curved in a half circle.

Length, 1.36 mm. Length of cephalothorax, 0.62 mm.; width, 0.49 mm.; tibia-patella 1, 0.47 mm.; tibia-patella 4, 0.53 mm.

Type locality.—UTAH: Mirror Lake, Uintah Mts., August 18, 1942, ♂ holotype, (W. Ivie coll.).

Tachygyna sima, new species

Figs. 137, 138

Female.—Color: Carapace light brown, conspicuously marked with dusky; eyes on black spots which are connected together. Chelicerae light brown, paler distally. Endites dusky brown with light tips. Legs and palpi pale brown, with the joints narrowly shaded. Abdomen blackish. Spinnerets light brown. Epigynum brown, shaded with dusky.

Structure: Size small. Carapace essentially normal; median groove present. Clypeus slightly protruding; height 1.8 diameters of a. s. eye. A. m. eyes much smaller than the others, which are large; eye area occupies about 0.8 width of head. Posterior eye row straight; p. m. eye about 0.8 diameter apart, 0.5 diameter from side eye. Anterior row straight; a. m. eye about 0.8 diameter apart, 0.9 diameter from side eye. Median ocular quadrangle about as wide as long, wider behind than in front.

Chelicerae vertical; stridulating file present. Sternum large, truncate behind; separates hind coxae by more than a diameter. Legs, palpi and abdomen normal. Epigynum large and rather long.

Length, 1.35 mm. Length of cephalothorax, 0.66 mm.; width, 0.50 mm. Length of tibia-patella 1, 0.56 mm.; tibia-patella 4, 0.62 mm.

Type locality.—BRITISH COLUMBIA: Vancouver Id., Sidney, ♀ holotype taken by R. V. Chamberlin and W. Ivie, Sept. 10, 1935.

Tachygyna watona, new species

Figs. 133, 134

Female.—Color: Carapace light yellowish brown, lateral margins lightly shaded; eyes on black spots. Chelicerae and endites yellowish brown. Sternum and labium dusky yellow. Legs and palpi light

yellowish brown; the distal end of coxae shaded on ventral side. Abdomen light gray. Spinnerets light brownish yellow. Epigynum brownish.

Structure: Size small. Carapace normal. Clypeus slightly protruding; height a 2.0 diameters of a. s. eye. Eye area occupies about 0.6 width of head; a. m. eye much smaller than the others. Posterior eye row procurved; p. m. eye about 1.1 diameters apart, 1.0 diameter from side eye. Anterior row faintly recurved; a. m. eye about 0.7 diameter apart, 0.9 diameter from side. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae moderately short, slightly reclined. Sternum large; separates hind coxae by more than a diameter. Legs moderately short; tarsi 1 and 2 nearly as long as metatarsi. Abdomen normal. Epigynum typical, with minor variations.

Length 1.4 mm. Length of cephalothorax, 0.64 mm.; width, 0.50 mm. Length of tibia-patella 1, 0.50 mm.; of tibia-patella 4, 0.57 mm.

Type locality.—UTAH: Mirror Lake, Uintah Mts., Oct. 15, 1939, ♀ holotype.

Genus **Tapinocyba** Simon, 1884

Arachnides de France, 5: 778.

Generotype: *Topincyba praecox* Cambridge.

Tapinocyba alpha, new species

Figs. 154, 155, 156

Carapace with ground color a pale grayish tan, with pars thoracica dusky and the lateral margins black; on the caudal part of the head a shield-shaped dusky area from the front of which three dark lines run forward, the middle one of these extending only part way to the eyes and the lateral ones reaching to or nearly to the lateral eye on each side behind which there is a well defined dark dot. Legs clear pale yellow. Sternum of same color as carapace, dusky throughout. Endites clear yellow. Abdomen dusky or nearly black throughout. Spinnerets pale.

Posterior row of eyes recurved, the medians not fully their diameter apart and slightly closer to the laterals. Quadrangle of median eyes much narrower in front than behind. Anterior row of eyes straight, the eyes contiguous, the medians notably smaller than the laterals, the black area on which they stand extending some distance down on clypeus. Furrow of chelicerae with three large teeth on anterior margin and two small ones on posterior margin.

Epigynum as shown in fig. 154, and the features of the male palpus as shown in figs. 155 and 156.

Length, 1 mm.

Type locality.—UTAH: Salt Lake City, Dry Creek Canyon, ♂♂, 1 ♀, Oct. 22 and 30, 1932. Also paratype, summer of 1933.

Tapinocyba (?) gamma, new species

Fig. 153

Carapace yellow, with a shield-shaped area outlined in black and bisected by a longitudinal median black line, a line extending forward

from each anterior corner to a posterior lateral eye and a fine median line running forward to a point between the posterior median eyes; carapace also dusky on lower sides, especially along margins. Legs clear yellow. The rather strongly convex sternum dusky over yellow. Endites yellow. Labium dusky across anterior border. Abdomen solid black throughout but the spinnerets yellow.

Posterior row of eyes a little procurved; median about their diameter apart, obviously nearer to the laterals. Anterior row of eyes straight, the eyes nearly contiguous, with the medians notably smaller than the laterals. Anterior margin of furrow of chelicera with three relatively large and well spaced teeth; the posterior margins with fine small teeth in a close series.

Epigynum as shown in fig. 153.

Length, 1.3 mm.

Type locality.—UTAH: Uintah Mts., Mirror Lake, several ♀ ♀ taken July 28, 1936, by W. Ivie.

Tapinocyba idahoana, new species

Figs. 129, 130

Female.—Color: Carapace dark dusky brown. Chelicerae light brown. Labium and sternum dark dusky brown; endites a little lighter. Legs and palpi light brown. Abdomen dense black. Spinnerets dusky brown. Epigynum dusky brown.

Structure: Size small. General structure short and broad; legs short. Carapace broad; head narrowed; clypeus rounded across front. Chelicerae very slightly protruding; height about 2.5 diameters of a. s. eye. Eye area occupies about 0.7 width of head; eyes a little above average in size; a. m. eyes smaller than the others. Posterior eye row faintly procurved; p. m. eyes about 1.0 diameter apart, about 0.8 diameter from side eyes. Anterior row straight; a. m. eyes 0.5 diameter apart, 0.6 diameter from side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae slightly reclined; fang groove with four teeth in front, four small teeth behind. Sternum a little wider than long; broadly truncate behind, separating the hind coxae by a full length of one of them. Legs short. Abdomen moderately wide. Epigynum consists of a short, flattened lobe extending posteriorly, with the tip split at the middle; with a small cavity near middle of ventral side, which contains the openings; and with a wide, rounded dorsal plate, concealed with the tip divided in the middle for a short distance.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.45	234
Cephalothorax:		
Length	0.62	100
Width	0.56	90
Tibia-patella:		
1	0.48	77
4	0.55	89

Type locality.—IDAHO: 2 mi. N. E. Fruitland, June 30, 1943, ♀, W. Ivie.

Tapinocyba iowa new species

Figs. 124, 125

Female.—Color: Carapace light brownish yellow, shaded with dusky on the lateral margins and with black rings around the eyes. Chelicerae and endites orange. Sternum and labium dusky yellow. Legs and palpi light yellow, with end of coxae narrowly margined with black. Abdomen dark gray. Spinnerets light brown.

Structure: Size small; slightly elongate. Eye area occupying three-fourths width of head. Anterior median eyes a little smaller than the others. Posterior row about straight; p. m. eyes 0.9 diameter apart, 0.6 diameter from side eyes. Anterior row straight; a. m. eyes 0.3 diameter apart, 0.4 diameter from side eyes. Height of clypeus 1.7 diameter of a. s. eye. Median ocular quadrangle wider behind than in front, about as wide as long. Chelicerae vertical; fang groove with five very small teeth in front and four denticles behind. Legs moderately long. Epigynum small, flat; with a pair of small openings on the dorsal side of the tip.

Measurements:

♀	*Mm.*	*Ratio*
Length	1.30	232
Cephalothorax:		
Length	0.56	100
Width	0.40	71
Tibia-patella:		
1	0.56	100
4	0.60	107

Type locality.—IOWA: Washington Co., 1935, ♀, Floyd Andre.

Tapinocyba kesimba, new species

Figs. 117–121

Male, female.—Color: Carapace pale brownish-yellowish, sometimes lightly marked with dusky; eyes on black spots. Chelicerae light orange brown. Endites pale orange. Sternum and labium yellowish, more or less shaded with dusky. Palpi and legs yellowish. Abdomen pale or medium gray. Spinnerets yellowish, sometimes lightly shaded with dusky. Epigynum yellowish brown and dusky.

Structure: Size small. Carapace oval; head of male slightly elevated with posterior rise abrupt; head of female normal. Eye area occupies about 0.6 width of head. Clypeus high, slightly protruding; height about 3.0 diameters of a. s. eye in male, about 2.2 diameters in female. Eyes of medium size; a. m. much smaller than a. s., p. m. smaller than p. s. Posterior row slightly recurved; p. m. eyes about 1.0 diameter apart, about 0.6 diameter from side eyes. Anterior row straight; a. m. eyes 0.4 diameter apart, 0.6 diameter from side eyes. Median ocular quadrangle barely wider than long, wider behind than in front.

Chelicerae vertical; fang groove with four small teeth in front, two tiny teeth behind. Legs moderately small and slender, sternum normal. Male palpus with a moderately long, pointed dorsal process and with a single stout spine near base above; paracymbium slender and

strongly hooked; embolic division with a tooth-shaped tail-piece, a heavy middle section, and two curved thin, flattened terminal processes; the latter protected by a broad flat lamella. Epigynum with a large posterior plate, which is deeply cleft medially in front, and through which two comma-shaped dark spots appear; with an anterior lip-like process partly overlapping broad cavity.

Measurements:

	♂		♀	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.50	250	1.40	233
Cephalothorax:				
Length	0.60	100	0.60	100
Width	0.45	75	0.45	75
Tibia-patella:				
1	0.56	93	0.50	83
4	0.62	103	0.53	88

Type locality.—ARIZONA: Kaibab Forest (V. T. Ranch), September 4, 1931, 2♂, 6♀, R. V. Chamberlin.

Other records.—ARIZONA: Kaibab Forest, September 4, 1931, 2♂, 6♀, R. V. Chamberlin. UTAH: Henry Mts., Sept. 9, 1929, ♂, 5♀, R. V. Chamberlin and W. J. Gertsch; Fish Lake, Sept. 4, 1929, 4♀, R. V. Chamberlin and W. J. Gertsch; Strawberry Res., Sept. 2, 1928, ♀, R. V. Chamberlin.

Tapinocyba (?) phana, new species

Fig. 126

Female.—Color: Carapace light yellowish-brown, lightly marked with dusky, and with side margins and interocular area blackish. Chelicerae light orange brown. Endites pale yellowish, lightly marked with dusky. Sternum and labium dark dusky over yellow. Legs and palpi light yellowish. Abdomen dark gray. Spinnerets dusky yellow.

Structure: Size small; body slightly elongate. Carapace narrow; clypeus rounded across front; slightly humped back of eyes. Eye area occupies about 0.6 width of head. Posterior eye row recurved; p. m. eyes 1.0 diameter apart, 0.5 diameter from side eyes. Anterior row slightly procurved; a. m. eyes 0.3 diameter apart, 0.3 diameter from the larger side eyes. Median ocular quadrangle a little wider than long, wider behind than in front. Chelicerae about vertical; fang groove with three small teeth in front, two small teeth behind. Sternum large, convex; truncate posterior end separates hind coxae by more than a diameter. Abdomen slightly elongate. Epigynum covered with a large, transversely oval, clear plate, two large spermathecae in front of the ectal corners.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.52	241
Cephalothorax:		
Length	0.63	100
Width	0.41	65
Tibia-patella:		
1	0.58	92
4	0.60	95

Type locality.—IDAHO: 4 mi. N. E. McCall, October 18, 1944, ♀.

Tapinocyba (?) pontis, new species

Figs. 127, 128

Female.—Color: Carapace light brownish yellow, lightly marked with dusky; eyes on black spots. Chelicerae and endites orange brown. Sternum and labium dusky. Legs and palpi light yellowish. Abdomen light to medium gray. Spinnerets yellowish. Epigynum yellowish and dusky.

Structure: Size small, body slightly elongate. Carapace ovoid, head moderately broad, slightly convex back of the eyes. Height of clypeus about 2 diameters of an a. s. eye. Eye area occupies about 0.6 width of head. A. m. eyes much smaller than the others. Posterior eye row procurved; p. m. eyes about a diameter apart, about 0.7 diameter from side eyes. Anterior row faintly recurved; a. m. eyes about 0.3 diameter apart, about 0.5 diameter from side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae slightly reclined, moderately short; fang groove with four teeth in front, five teeth behind. Sternum normal; separates hind coxae by about a diameter. Legs normal. Epigynum simple, with a large opening posteriorly which is mostly filled by the rounded posterior sclerite.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.35	208
Cephalothorax:		
Length	0.65	100
Width	0.49	75
Tibia-patella:		
1	0.50	77
4	0.57	88

Type locality.—WYOMING: Bridge Bay, Yellowstone Lake, August 11, 1940, 2 ♀.

Tapinocyba sucra, new species

Figs. 122, 123

Female.—Color: Carapace brown, lightly marked with dusky. Chelicerae and endites orange brown. Sternum and labium dusky brown. Legs and palpi yellowish. Abdomen dark gray. Spinnerets yellowish. Epigynum dusky brown.

Structure: Size small. Carapace essentially normal; clypeus slightly protruding; head slightly elevated back of the eyes, height of clypeus about 2 diameters of an a. s. eye. Eye area occupying most of the width of the head. A. m. eyes much smaller than the others. Posterior row slightly procurved; p. m. eyes about 1.1 diameters apart, about 0.9 diameters from side eyes. A. m. eyes about 0.7 diameter apart, 1.0 diameter from the side eyes. Median ocular quadrangle wider behind than in front, about as wide behind as long. Chelicerae reclined. Epigynum simple, with two small round openings.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.30	217
Cephalothorax:		
Length	0.60	100
Width	0.48	80
Tibia-patella:		
1	0.45	75
4	0.48	80

Type locality.—OHIO: Sugar Grove, Aug. 17, 1935, W. Ivie and W. M. Barrows.

Tapinocyba (?) vermontis, new species

Fig. 152

Female.—Color: Carapace yellowish brown, lightly shaded with dusky; space between the eyes blackish. Chelicerae and endites orange. Sternum and labium dusky brown punctate with small white dots. Palpi and legs yellow, legs more or less shaded at the proximal joints. Abdomen light gray. Spinnerets orange. Epigynum dusky brown.

Structure: Size small. Structure essentially normal. Eye area occupying nearly two-thirds of head. A. m. eyes much smaller than the others. Posterior eye row slightly procurved; p. m. eyes about a diameter apart, about a radius from the side eyes. Posterior row straight; eyes sub-contiguous. Median ocular quadrangle more than twice as wide behind as in front. Height of clypeus 2 diameters of an a. s. eye. Epigynum a flattened plate, with a W-shaped dusky pattern showing through.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.20	200
Cephalothorax:		
Length	0.60	100
Width	0.44	73
Tibia-patella:		
1	0.50	83
4	0.55	92

Type locality.—VERMONT: Jamaica, July 11, 1913, ♀, R. V. Chamberlin.

Genus **Tigellinus** Simon, 1884

Arachnides de France, 5: 838.

Generotype: *Tigellinus furcillatus* (Menge).

Tigellinus (?) perditus, new species

Fig. 131

Female.—Color: Carapace brown. Chelicerae and endites light reddish brown with lighter tips. Sternum brown, slightly dusky at the margins; labium dusky brown. Legs and palpi yellowish brown. Abdomen dark gray. Spinnerets yellow. Epigynum reddish brown.

Structure: Size medium; body somewhat elongate; legs moderately short. Carapace normal, slightly elongate, head narrowed. Height

of clypeus a little more than 2 diameters of an a. s. eye. Eye area occupies about two-thirds width of head. Eyes about equal. Posterior eye row straight; p. m. eyes about 1.0 diameter apart, 0.8 diameter from side eyes. Anterior row straight; a. m. eyes 0.2 or 0.3 diameter apart, 0.5 to 0.6 diameter from the side eyes. Median ocular quadrangle slightly longer than wide, wider behind than in front. Chelicerae vertical; fang groove without teeth on its margins. Sternum large, separates hind coxae by a little more than a diameter. Legs moderately short. Abdomen large, elongate, oval. Epigynum consists of a large, somewhat quadrangular, shiny, elongate plate.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.00	267
Cephalothorax:		
Length	0.75	100
Width	0.58	77
Tibia-patella:		
1	0.68	90
4	0.80	107

Type locality.—Uncertain, no data, probably vicinity of Salt Lake City, Utah, 2 ♀.

Tigellinus mesus, new species

Fig. 132

Female.—Carapace dark brown, inconspicuously marked with dusky. Chelicerae and endites dusky brown. Sternum and labium brownish black. Palpi and legs brownish orange, with the tibiae of legs 1 and 2 and tibia and tarsus of palpus blackish brown; tibia 3 and 4 shaded, but lighter than 1 and 2. Abdomen shiny black. Spinnerets and epigynum dusky brown.

Side medium. Carapace ovoid; head narrow and slightly elevated. Height of clypeus about 3.5 diameters of an a. s. eye. Eye area occupies about two-thirds the width of the head; eyes sub-equal. Posterior eye row slightly procurved; p. m. eyes about 0.9 diameter apart, same distance from side eyes. Anterior row straight; a. m. eyes about 0.5 diameter apart, same distance from larger side eyes. Median ocular quadrangle much longer than wide, a little wider behind than in front. Chelicerae vertical. Sternum normal; hind coxae separated by about a diameter. Legs moderately large. Abdomen broad. Epigynum with a large posterior plate, appearing as a transverse bar in ventral view, in front of which is a transverse opening.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.50	250
Cephalothorax:		
Length	1.00	100
Width	0.72	72
Tibia-patella:		
1	0.95	95
4	1.07	107

Type locality.—COLORADO: Pikes Peak (11,600 ft.), June 22, 1940, ♀, W. Ivie.

Tigellinus weber, new species

Fig. 160

Carapace dusky chestnut. Legs light orange yellow. Sternum dusky chestnut. Endites orange. Abdomen black above and over the sides, the venter grayish black except in front of the furrow where the color is yellow.

Posterior row of eyes procurved, eyes subequal, or the medians a little larger; medians a little more than their diameter apart. Quadrangle of median eyes longer than wide, narrower in front than behind. Anterior lateral eyes larger than the posterior laterals. Anterior row of eyes a little recurved; median eyes smaller than the laterals, subcontiguous with each other, about their radius from the laterals. Anterior margin of furrow of chelicera with four teeth which decrease gradually in height to the most distal one; posterior margin with a single tooth.

Epigynum as shown in fig. 160.

Length,

Type locality.—UTAH: Smith and Morehouse branch of the Weber Canyon, ♀ holotype taken October 7, 1932, by R. V. Chamberlin.

Genus **Tortembolus** Crosby

Proc. Calif. Acad. Sci., 14: 115.

Orthotype: *Tortembolus tortuosus* Crosby.

Tortembolus approximatus, new species

Figs. 140–144

Male, female.—Color: Carapace light yellowish brown, sometimes lightly marked with dusky; eyes on black spots. Chelicerae light brown. Endites light orange brown. Sternum and labium dusky over yellow to dark dusky. Legs and palpi yellow or light brownish; palpal organs brownish and dusky. Abdomen dark gray; epigastric area pale. Spinnerets light brownish yellow. Epigynum pale yellow and light dusky.

Female.—Structure: Size medium. Carapace moderately large, slightly elongate; median groove absent; head slightly humped back of eyes. Clypeus protruding; height about 3.0 diameters of a. s. eye. Eyes small, imperfect; eye area occupies about 0.6 width of head. Posterior eye row faintly recurved; p. m. eye about 1.6 diameters apart, 1.6 diameters from side eyes. Anterior row faintly recurved; a. m. eyes about 0.7 diameter apart, 1.2 diameters from the larger side eyes. Median ocular quadrangle about as wide as long, wider behind than in front.

Chelicerae slightly reclined; stridulating file weak, but distinct; fang groove with five teeth in front, four behind. Sternum normal, separates hind coxae by a little less than a diameter. Palpus slender, several long spines on the tarsus. Legs moderately long and slender distally. Abdomen normal. Epigynum with a large, laterally broad and longitudinally narrow, clear sclerite; separated from anterior rim by a narrow, transverse, slit.

Male.—Structure: Carapace with thoracic part rather low; head broadly elevated, with a deep pit back of each p. s. eye; median groove

absent. Clypeus nearly vertical; height about 4.0 diameters of an a. s. eye. Eyes small, all in front and below cephalic lobe. Anterior eye row straight; a. m. eye about 0.8 diameter apart, 2.8 diameters from side eyes. Posterior row slightly recurved from above (procurved from in front) p. m. eye about 2.0 diameters apart, 2.0 diameters from side eye. Median ocular quadrangle about as wide as long, much wider behind than in front.

Chelicerae moderately weak; slightly reclined; fang groove with five teeth in front, four small teeth behind. Sternum broad, pointed behind; separates hind coxae by less than a diameter.

Palpus moderately large. Femur and patella normal. Tibia much enlarged, the ectal part formed into two rounded lobes, the mesal part extended as a long heavy process, hind ectad. Cymbium and paracymbium normal, moderately small. Embolus long, heavy, coiled, contorted at distal end; the tail-pieces small; tigulum distorted.

Measurements:

	♀		♂	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	2.60	136	2.50	200
Cephalothorax:				
Length	1.10	100	1.25	100
Width	0.88	80	1.00	80
Tibia-patella:				
1	1.10	100	1.20	96
4	1.17	106	1.25	100

Type locality.—OREGON: Jackson Co., April 6, 1927, ♀, J. C. Chamberlin.

Other records.—CALIFORNIA: Atlerton, December, 1927, ♂, J. C. Chamberlin; Saratoga, March 25, 1928, ♂, J. C. Chamberlin; Riverton, July 15, 1935, ♀, W. Ivie; 48 m. No. Willets, March 4, 1938, ♂, 2 ♀♀, J. C. Chamberlin; Pacific Grove, August, 1937, 2 ♀, W. Ivie. OREGON: W. Corvallis, March 20, 1937, ♂ 4 ♀, J. C. Chamberlin.

Tortembolus monicus, new species

Fig. 139

Female.—Color: Carapace light yellowish brown, with distinct dusky markings of essentially the usual pattern. Chelicerae and endites light orange brown. Sternum and labium dark dusky brown. Legs and palpi light yellow. Abdomen blackish. Spinnerets pale yellow. Epigynum dusky, brownish and yellowish.

Structure: Size small, body moderately slender; legs short. Carapace normal; head raised slightly back of the eyes. Clypeus protruding; height about 2.0 diameter of an a. s. eye. Eye area occupies about 0.6 width of head. Eyes unequal, order of size being a. s., p. m., p. s., a. m.; the a. m. eyes less than half the diameter of the a. s. eyes. Posterior eye row slightly recurved; p. m. eyes 1.2 diameters apart, 0.8 diameter from side eyes. Anterior row slightly recurved; a. m. eyes about 0.4 diameter apart, 1.0 diameter from the side eyes. Median ocular area faintly wider than long, much wider behind than in front. Chelicerae slightly reclined; short. Sternum normal, obtuse behind; hind coxae separated by a little more than a diameter. Legs moderately short. Epigynum large; the principal sclerite is a broad, slender, inverted T.

Measurements:

	♀ *Mm.*	*Ratio*
Length	1.32	236
Cephalothorax:		
Length	0.56	100
Width	0.44	79
Tibia-patella:		
1	0.46	82
4	0.52	93

Type locality.—CALIFORNIA: Santa Monica, December 19, 1933, ♀.

Genus **Willibaldia** Keyserling, 1886

Die Spinnen Amerikas, 2(2): 123.

Generotype: *Willibaldia cavernicola* Keyserling.

Willibaldia (?) sodonta, new species

Fig. 146

Female.—Color: Carapace light brown; eyes on black spots. Chelicerae light brown. Endites light brownish orange, with pale tips. Sternum and labium light yellowish brown, very lightly shaded with dusky. Legs and palpi bright light brownish orange. Abdomen medium gray. Spinnerets light yellowish brown. Epigynum dusky brown.

Structure: Size medium large. Carapace normal in outline, head slightly humped back of the eyes; median groove absent. Clypeus nearly vertical; height about 0.3 diameter of a. s. eye. Eye area occupies about 0.7 width of head. Post eye row straight; p. m. eye about 1.3 diameters apart, 1.5 diameters from side eye. Anterior row straight; a. m. eye about 0.8 diameter apart, 1.7 diameters from side eye. Median ocular quadrangle with width in front equaling length, broader behind than in front.

Chelicerae reclined, moderately long; fang groove with three large teeth, close together in front, five small teeth behind. Endites moderately small. Sternum heart-shaped, median sized; hind coxae separated by a diameter. Palpi small. Legs rather large. Abdomen moderately small. Epigynum with a large transverse oval opening situated between an anterior and posterior ridge.

Measurements:

	♀ *Mm.*	*Ratio*
Length	2.35	214
Cephalothorax:		
Length	1.10	100
Width	0.87	80
Tibia-patella:		
1	1.20	109
4	1.26	115

Type locality.—WASHINGTON: White R. Camp, Rainier Park, July 6, 1938, ♀.

Genus **Wubana** Chamberlin, 1919

Ann. Ent. Soc. America, 12: 252.

Orthotype: *Wubana drassoides* (Emerton).

Wubana reminiscens, new species

Fig. 145

Female.—Color: Carapace light brown. Chelicerae light brown. Endites orange. Sternum and labium brown. Legs and palpi brownish yellow. Abdomen dark gray, with a large white spot above the spinnerets and with inconspicuous transverse lines and specks of light gray above. Spinnerets light yellowish. Epigynum light yellowish and reddish brown.

Structure: Carapace ovoid, narrowed in front; head slightly convex back of eyes. Height of clypeus about 2.2 diameters of a. m. eye. Eye area occupies about 0.6 width of head at posterior eye row. Posterior eye row straight; p. m. eyes 1.0 diameter apart, 0.6 diameter from side eyes. Anterior row faintly procurved; a. m. eyes about 0.4 diameter apart, same distance from larger side eyes. Median ocular quadrangle slightly wider than long, wider behind than in front. Chelicerae vertical; fang groove with two small teeth behind, none in front. Endites about as long as wide, convergent around labium. Labium wider than long. Sternum cordiform; separates hind coxae by about a diameter. Palpi small, spined, without terminal claw. Legs moderately long; stout basally, very slender distally; paired claws with a large tooth on under side. Abdomen normal; moderately high. Colulus distinct. Epigynum produced posteriorly into a single, straight, finger like projection.

Measurements:

	♀	
	Mm.	*Ratio*
Length	2.80	244
Cephalothorax:		
Length	1.15	100
Width	0.95	83
Tibia-patella:		
1	1.30	113
4	1.45	126

Type locality: WYOMING: Yellowstone Park, August 14, 1927, ♀, R. V. Chamberlin.

Genus **Zygottus**, new

A genus in some respects suggesting *Sisicottus* but the embolus of the male palpus short and not in a coil. The tibial apophysis of the male palpus arising at distal end and relatively long and slender and directed distad. The epigynum simple, presenting at caudal border a relatively small embayment.

Orthotype: *Zygottus corvallis* new species.

This genus as at present recognized embraces the two new species described below.

Zygottus corvallis, new species

Figs. 147–149

Male, female.—Color: Carapace light brown lightly marked with dusky. Chelicerae light brown. Endites light brown to dusky brown with pale tips. Sternum and labium dark dusky brown. Legs and palpi light yellowish brown, the distal tip of femora and base of tibiae usually somewhat paler than the rest. Abdomen medium to dark gray. Spinnerets light yellowish brown. Epigynum yellowish or brownish and dusky.

Structure: Carapace essentially normal, moderately short and broad; not modified in the male. Clypeus vertical; height about 2.8 diameters of a. s. eye. Eye area occupies about 0.7 width of head; a. m. eyes smaller than the others. Posterior eye row straight; p. m. eyes 0.9 diameter apart, 0.8 diameter from side eyes. Anterior row straight; a. m. eyes about 0.6 diameter apart, 0.8 diameter from the side eyes. Median ocular quadrangle about as long as wide, much wider behind than in front.

Chelicerae slightly reclined; stridulating file apparently absent; fang groove with four teeth in front, four small teeth behind. Sternum moderately large, convex, truncate behind; separates hind coxae by slightly more than a diameter. Palpus moderately small. Femur normal. Patella normal, short, barely longer than wide. Tibia slightly inflated, with a long, slender, curved process on the mesal side. Cymbium and paracymbium normal. Embolic division short; with a short, spatulate tail-piece, a somewhat enlarged middle section, and a very short embolus.

Measurements:

	♀		♂	
	Mm.	*Ratio*	*Mm.*	*Ratio*
Length	1.77	253	1.40	200
Cephalothorax:				
Length	0.70	100	0.70	100
Width	0.60	86	0.60	86
Tibia-patella:				
1	0.60	86	0.70	100
4	0.72	103	0.74	106

Type locality.—WASHINGTON: Denny Cr., Snoqualmie Pass, August 16, 1935, 5 ♀, W. Ivie.

Other records.—OREGON: 6 mi. W. Corvallis, May 9, 1936, 4 ♀, J. C. Chamberlin; Divide, April 28, 1937, 2 ♂ 6 ♀, J. C. Chamberlin.

Zygottus oregonus, new species

Figs. 150, 151

Female.—Color: Carapace yellowish brown, with dusky markings in the usual pattern; inter-ocular area mostly blackish. Chelicerae light brown. Sternum, labium and endites dusky brown. Legs and palpi light yellowish. Abdomen dark gray. Spinnerets brownish yellow. Epigynum light dusky over yellowish and light brownish.

Structure: Size small. Carapace normal. Height of clypeus about 2.5 diameters of an a. s. eye. Head slightly convex back of eyes. A. m.

eyes much smaller than the others; eye area occupies about 0.65 width of head. Posterior eye row straight; p. m. eyes 1.0 diameter apart, 0.9 diameter from side eyes. Anterior row slightly recurved; a. m. eyes 0.8 diameter apart, 1.0 diameter from side eyes. Median ocular quadrangle longer than wide, wider behind than in front.

Chelicerae slightly reclined; fang groove with five teeth in front, five small teeth behind. Sternum normal, posterior tip rounded; hind coxae separated by a little more than a diameter. Epigynum small; from ventral view consists of a small indentation in the posterior rim, in which a pair of small openings are concealed.

Measurements:

	♀	
	Mm.	*Ratio*
Length	1.50	224
Cephalothorax:		
Length	0.67	100
Width	0.54	81
Tibia-patella:		
1	0.57	85
4	0.63	94

Type locality.—OREGON: S. Denmark, April 27, 1938, ♀, J. C. Chamberlin.

BOOK NOTICES

SPIDERS OF CONNECTICUT, by BENJAMIN JULIAN KASTON. Connecticut State Geol. and Nat. Hist. Survey, Bull. 70, 874 pages, 6 text figures, 1 map, 142 plates. 1948.

Though the reviewer knows little about araneology, this appears to him to be a worthy companion to the various volumes on the insects of Connecticut and should prove as valuable as its predecessors in the study, not only of the New England fauna, but in that of other parts of temperate North America as well. The general treatment of external and internal anatomy, to which fifteen pages and the six text figures are devoted, together with the keys, descriptions, a glossary, and the apparently well-executed illustrations, should greatly facilitate identifications.

The biology of the spiders is not neglected. Pages 27 to 44 are devoted to an account of the life history and habits, to parasites and other natural enemies, and to the economic aspects, including an account of arachnidism. In addition to this, a great deal of biological information is included in the separate accounts of the species, and twenty-nine plates are devoted to photographs showing such material as habitus studies, webs, spiderlings, and egg masses.

The manuscript was completed in 1941 and was delayed in publication, presumably by the war. As a result of this, some changes were made, with the result that some necessary inconsistencies occur. The absence of plates XXXII and LXVIII is perhaps the most noticeable of these.—M.T.J.

THE CHRYSOMELIDAE OR LEAF BEETLES OF GEORGIA, by P. W. FATTIG. Emory Univ. Museum Bull. 6. 47 pp. September 1, 1948.

This study lists 417 species and varieties of leaf beetles recorded from Georgia, with distributional and seasonal data. This is the sixth of a series, the previous numbers having dealt with the Mutillidae, Phyllophaga, the Asilidae, the Tabanidae, and the Cerambycidae.

Dr. Fattig's methods are not to be recommended to those compilers of lists who are anxious to break into print. His collections are made over considerable periods of time (twenty-one years in the present case), and the manuscripts are checked by specialists in the various groups so that the nomenclature becomes consistent within itself. Done in this way, a list of this type becomes a permanent contribution to the literature of entomology.—M.T.J.

MALARIA CONTROL ON IMPOUNDED WATER, by E. L. BISHOP, M. D. HOLLIS, C. I. MANSUR, and others. The United States Public Health Service and the Tennessee Valley Authority. xiv+422 pp., 215 figs., 43 tables. 1947.

This manual, which is intended to serve as a guide for engineers, medical officers and others concerned with the administration of control operations, attempts to present the basic principles and the modern practices of malaria control as applied to the impounded waters of flowing streams. Full consideration is given to the planning of malaria control programs for both proposed and existing empoundages, to primary antilarval measures and their application, to supplementary control measures such as mosquito-proofing and house-spraying, to the necessary facilities, field operations, and reports, and to the training of personelle. A general discussion of anopheline mosquitoes, their identification, biology, ecology, and relationship to malaria is included. The relationship of the control measures to wild life is discussed. Legal aspects, including summaries of the various state laws, are considered.

The purpose of the work is primarily utilitarian, and no claims are made except for the presentation of the best available information for practical purposes. As one would expect, references are few in number, and descriptions of technique

rather complete. Even the more technical parts of the work are easy to read. Most of the illustrations are quite clear; the color photographs are especially notable. The book presents a good appearance, with a good grade of paper and permanent binding.

The work as a whole appears quite well done. The reference to one malaria mosquito as *Anopheles freeborni* in one place and as *A. maculipennis freeborni* in another may be confusing to some. In addition to the use for which it was intended, the work will be of value to teachers and students of medical entomology.—M.T.J.

REVISTA ECUATORIANA DE HIGYENE Y MEDICINA TROPICAL.—An examination of volume 3, 1946, which was received for review, indicates that this journal publishes some work of interest to medical entomologists. There are two such papers in this volume: "Encuestas de malaria en el litoral Ecuatoriano" (Anonymous), pp. 124–148, 2 figures, 24 tables; and "Las moscas, como agentes vectores de enfermedades entéricas en Guayaquil," by Clodoveo Alcivar Z. and Francisco Campos R., pp. 3–14, 1+5 tables, 1 graph. Other articles, for example, "Limite fisico-quimicos de lo viviente," by José Crusellas Ventura, pp. 55–61, will interest some entomologists.—M.T.J.

HANDBOOK ON INSECT ENEMIES OF FLOWERS AND SHRUBS, by C. A. Weigel and L. G. Baumhofer. U. S. D. A. Misc. Pub. No. 626. iii+115 pages, 170 figures. 1948. Price, 35 cents.

This handbook is designed for the use of the home gardener in recognizing the common insect and related pests he may encounter in the flower garden and in applying the proper remedies. The first part (pp. 2–18) deals with general insect pests, such as cutworms, grasshoppers, aphids, and sowbugs. The second part (pp. 18–94) treats insects attacking specific plants; only the chief pests are considered under each plant, but a cross index refers to others that are considered either in this or in the previous part. The remaining pages are devoted to a discussion of insecticides and their application, to dusting and spraying equipment, and to an index.

A great deal of information is contained in this booklet, and much of it will be of permanent value. The chief limitation, which is admitted in the preface, is that it was prepared prior to the development of the new insecticides; of these, only DDT is mentioned, and the discussion of it is placed in an appendix.—M.T.J.

INDEX TO VOLUME XLI

All new names are printed in *italics*

All new names are printed in *italics*.
Aedes, 51.
  trivittatus, 51.
Abdel-Malek, Albert, article by, 51.
Acarina, 479.
Aitken, Thomas H. G., article by, 327.
Alexander, Charles P., article by, 137.
Allepeira, 309.
  leminscata, 309.
Allepeirinae, 309.
Anacornia, 483.
  microps, 483.
  proceps, 483.
Anderson, W. H., article by, 413.
Anopheles, 327.
Aphidae, 384, 393.
Apidae, 387.
Apis, 387
  mellifera, 387.
Araneida, 309, 483.
Argiopidae, 309.
Atkins, E. Laurence, Jr., article by, 387.
Austrolimnophila, 142.
  garrigoui, 142.

Bailey, Norman S., article by, 403.
Barber, H. S., article by, 478.
Basham, Ernestine H., article by, 1.
Bick, George H., article by, 360.
Bohart, George E., article by, 119.
Bohart, Richard M., article by, 330.
Book Notices, Authors:
  Baumhofer, L. G., 564.
  Bishop, E. L., 563.
  Brues, Charles T., 16.
  Fattig, P. W., 563.
  Hargraves, H., 412.
  Hayward, Kenneth J., 26, 40.
  Hollis, M. D., 563.
  Kaston, Benjamin Julian, 563.
  Kinsey, Alfred C., 57.
  Mansur, C. I., 563.
  Martin, Clyde E., 57.
  Pomeroy, Wardell B., 57.
  Ross, Herbert H., 376.
  Snodgrass, R. E., 386.
  Swain, Ralph B., 325.
  Weigel, C. A., 564.
Book Notices, Titles:
  Arthropoda, 467.
  Catalogus Hesperidarum Rei Publicae Colombianae, by Kenneth J. Hayward, 26.
  The Chrysomelidae or Leaf Beetles of Georgia, by P. W. Fattig, 563.
  The Feeding Organs of Arachnida, Including Mites and Ticks, by R. E. Snodgrass, 386.
  Handbook of Insect Enemies of Flowers and Shrubs, by C. A. Weigel and L. G. Baumhofer, 564.
  Hesperioidea Argentina, XVI, XVII, XVIII, by Kenneth J. Hayward, 40.
  The Insect Guide, by Ralph B. Swain, 325.
  Insects and Human Welfare, by Charles T. Brues, 16.
  List of Recorded Cotton Insects of the World, by H. Hargraves, 412.
  Malaria Control on Impounded Water, by E. L. Bishop, M. D. Hollis, C. I. Mansur, and others, 563.
  Revista Ecautoriana de Higyene y Medicine Tropical, 564.
  Sbornik Narodniho Musea v Praze (Acta Musei Nationalis Pragae), 368.
  Sexual Behavior in the Human Male, by Alfred C. Kinsey, Wardell B. Pomeroy and Clyde E. Martin, 57.
  Spiders of Connecticut, by Benjamin Julian Kaston, 563.
  A Textbook of Entomology, by Herbert H. Ross, 376.
Braconidae, 28, 439.
Bruce, W. N., article by, 346.
Bruner, S. C., article by, 63.
Byllisana, 65.
  brunnea, 65.

Cactophagus, 426.
Calendra, 369, 427.
  mormon, 369.
  multilineata, 370.
Calendrinae, 413.
Calendrini, 419.
Campsomeris, 59.
  annulata, 59.
  marginella, 59.
    modesta, 59.
Carthaeomorpha, 66.
  balloui, 66.
Catabrithorax, 484.
  clypiellus, 486.
  oxypaederotipus, 488.
  plumosus, 490.
  stylifer, 486.
Catosus, 488.
Ceraticelus, 491.
  agathus, 491.
  formosus, 492.
    pistus, 492.
  laetabilis, 492.
    pisga, 492.
  subniger, 491.
  tuganus, 494.

Ceratinella, 496.
brunnea, 499.
buna, 496.
diversa, 498.
hematha, 500.
holocerea, 500.
kenaba, 501.
ornatula, 501.
alaskana, 501.
placida, 502.
tigana, 504.
tosior, 506.
Ceratinops, 508.
uintana, 508.
Ceratinopsis, 509.
crosbyi, 510.
eutypa, 509.
gosibia, 512.
interventa, 514.
oregonicola, 510.
palomara, 511.
secuta, 512.
watsinga, 516.
Ceratocheilus, 146.
Chamberlin, Ralph V., article by, 483.
Cheraira, 518.
castoris, 520.
kena, 519.
salmonis, 520.
willapa, 518.
Cheumatopsyche, 400.
geora, 500.
halima, 400.
Chimarra, 24.
dentosa, 25.
perigua, 24.
Chremylus, 28.
rubiginosus, 28.
Chrysomelidae, 468.
Cicindela, 27.
repanda, 27.
maehleri, 27.
Cicindelidae, 27.
Cochlembolus, 522.
provo, 522.
Coleoptera, 27, 206, 369, 413, 468, 478.
Collembola, 353.
Coloncus, 522.
americanus, 524.
cascadeus, 524.
ocala, 524.
pius, 525.
siou, 525.
Conopidae, 223.
Conops, 226.
Cornicularia, 526.
selma, 526.
Corypheolana, 527.
oatimpa, 527.
Cosmopolites, 421.
Ctenocephalides, 346.
felis, 346.
Culex, 1, 330, 360.
apicalis, 336.
arizonensis, 341.
derivator, 345.
mulrennani, 1.
quinquefasciatus, 360.
reevesi, 342.
territans, 332.
Culicidae, 1, 51, 327, 330, 360.
Curculionidae, 369, 413.
Cyarda, 100.
scuminipennis, 100.
acutissima, 101.
cubensis, 101.
fuscifrons, 102.
haitensis, 103.
melichari, 103.
walkeri, 103.

Dakshiana, 68.
katharina, 70.
Dalmannia, 233.
blaisdelli, 234.
heterotricha, 235.
nigriceps, 234.
pacifica, 234.
picta, 234.
vitiosa, 234.
Denning, D. G., article by, 397.
Deocerus, 74.
Dermestidae, 478.
Diathetes, 424.
Diocalandra, 431.
Diptera, 1, 8, 51, 137, 189, 223, 247, 327, 330, 360, 387, 403, 455.
Discobola, 139.
Disembolus, 527.
apache, 527.
zygethus, 527.
Dolichopeza, 138.
austrocalendonica, 138.
Dolophilodes, 24.
Dryophthorus, 436.
Dufourea, 119.
afasciata, 130.
cuprea, 119.
dentipes, 132.
dilatipes, 135.
longiceps, 128.
pectinipes, 126.
trochantera, 121.
vandykei, 124.
Dynamis, 419.

Eperigone, 528.
socius, 528.
Erigonidae, 483.
Erioptera, 145.
caledonia, 145.
Eristalis, 387.
tenax, 387.
Eucalandra, 431.
Eularia, 530.
kaiba, 530.
quaestio, 531.
wioma, 530.
Exline, Harriet, article by, 309.

Fairchild, G. B., articles by, 247, 455.
Fisher, Charles K., article by, 450.
Flatarina, 114.
aguiari, 114.
Flatarissa, 106.
humeralis, 107.
variegata, 107.
Flatidae, 63.
Flatidula, 112.
luella, 112.
pallescens, 113.
Flatoidinus, 114.
acutus, 115.
bipunctatus, 116.
humeralis, 116.
maculosus, 116.
dotatus, 117.
lugubris, 118.
obscurus, 115.
olivaceus, 117.
pallescens, 117.
punctatus, 116,
Formica, 438.
exsecroides, 438.
Formicidae, 267, 438.

Gallinia, 22.
mohri, 23.
Grammonota, 531.
salicicola, 532.
Gurney, Ashley B., article by, 213.
Gynoplistia, 143.
caledonica, 143.
neocaledonica, 143.
williamsiana, 144.

Halictidae, 119.
Haviland, Elizabeth E., article by, 438.
Helius, 141.
aphrophilus, 141
Hemerobiidae, 213.
Hemerobius, 213.
neadelphus, 214.
Hemiptera, 371.
Hertig, Marshall, articles by, 8, 247, 455.
Hilaira, 532.
garrina, 532.
Homoptera, 63, 384, 393.
Hovanitz, William, article by, 48.
Hydropsyche, 398.
impula, 398.
Hymenoptera, 28, 58, 119, 267, 326, 387, 438, 439, 450.
Hypoaspinae, 479.
Hypoaspis, 479.
murinus, 479.

Ignotus, 478.

Jahn, Theodore Louis, article by, 258.

Kitzmiller, James B., article by, 393.
Koel, Bertram S., article by, 258.
Krombein, Karl V., article by, 58.

Laelaptidae, 479.
LaRivers, Ira, article by, 371.
Lee, Helen Tsui-Ying, article by, 200.
Leocerus, 74.
fuscus, 74.
Lepidoptera, 48, 200.
Limnephilus, 400.
gioia, 400.
Limonia, 139.
caledoniae, 139.
Lophomma, 533.
columbia, 533.

Macrosiphum, 393.
sanborni, 393.
Maso, 534.
marxi, 534.
matanuskae, 534.
navajo, 535.
Mason, Horatio C., article by, 28.
Masoncus, 536.
arienus, 536.
dux, 536.
nogales, 537.
Melanoconion, 1.
Melormenis, 86.
asymmetrica, 92.
frigida, 88.
inconspicua, 90.
maestralis, 90.
persea, 92.
pruinosa, 96.
cubana, 96.
siboney, 96.
variegata, 88.
Menzies, George C., article by, 479.
Metamasius, 429.
Metcalf, Z. P., article by, 63.
Meterioptera, 145.
Mills, Harlow B., article by, 353.
Minyriolus, 538.
pampia, 539.
plesius, 538.
Molophilus, 146.
vorax, 146.
Monoflata, 70.
perpusilla, 72.
Monoflatina, 72.
viridipennis, 72.
Montilaira, 539.
relicta, 540.
Munson, Sam C., article by, 377.
Mycetophilidae, 189.
Myocalandra, 430.
Myopa, 235.
aperta, 238.
clausa, 238.
curticornis, 238.
fenestrata, 236.
flavopilosa, 237.
longipilis, 237.
melanderi, 235.
plebeia, 237.
seminuda, 237.

varians, 236.
vesiculosa, 236.
vicaria, 236.
virginica, 237.
willistoni, 236.
Myrmica, 267.
lobicornis, 272.
alesptris, 274.
alpina, 274.
angustifrons, 274.
apennina, 274.
arduennae, 274.
deplanata, 276.
foreli, 276.
fracticornis, 276.
jessensis, 286.
kieviensis, 286.
lissahorensis, 287.
littoralis, 287.
lobulicornis, 287.
pyrenaea, 287.
myrmecophila, 270.
puerilis, 287.
rugulosa, 305.
caucasica, 306.
constricta, 306.
hellenica, 306.
limanica, 307.
chersonensis, 307.
strandi, 307.
slobodensis, 307.
ruginodiformis, 307.
rugulosa-scabrinodis, 308.
sabuleti, 288.
americana, 288.
hamulata, 293.
lonae, 294.
nearctica, 294.
pilosiscapus, 296.
scabrinodo-lobicornis, 296.
spinosior, 296.
schencki, 296.
brunescens, 297.
burtshak-abramovitschi, 297.
caucasicola, 298.
emeryana, 298.
kutteri, 301.
obscura, 302.
plana, 302.
salina, 302.
spatulata, 303.
starki, 304.
subopaca, 304.
tahoensis, 304.
sulcinodis, 267.
nigripes, 268.
sulcinodo-ruginodis, 268.
sulcinodo-rugulosa, 268.
sulcinodo-scabrinodis, 270.
vicaria, 270.

Naucoridae, 371.
Naucorinae, 371.
Neoamphorophora, 384.
tephrosiae, 384.
Neoculex, 330.
Neuroptera, 213.

Occemyia, 243.
abbreviata, 245.
longicornis, 245.
loraria, 244.
luteipes, 245.
modesta, 245.
nigra, 244.
nigripes, 244.
propinqua, 244.
Ochrotrichia, 398.
potomus, 398.
Oedothorax, 540.
cascadeus, 540.
Ormenana, 80.
fusca, 82.
linki, 80.
nana, 82.
punctata, 84.
Ormenaria, 78.
rufifascia, 78.
Ormenis, 76.
cubensis, 76.
Ormenoides, 86.
subflava, 86.
Orthoptera, 258.
Orthotrichia, 397.
instabilis, 397.
Oxyethira, 397.
grisea, 398.
janella, 397.

Paracotalpa, 207.
ursina, 207.
ursina, 207.
Paralimnophila, 143.
Parsons, Carl T., article by, 223.
Pelocoris, 371.
shoshone, 371.
Pemphredon, 326.
inornatus, 326.
Phacecorynes, 424.
Phacelodocera, 138.
margaritae, 138.
Philopotamidae, 17.
Phlebotomus, 247, 455.
atroclavatus, 455.
cyannensis, 460.
cyannensis, 460.
maciasi, 466.
puertoricensis, 462.
viequesensis, 464.
chiapanensis, 467.
cruciatus, 247.
ctenidophorus, 466.
gomezi, 252.
trinidadensis, 255.
Physocephala, 230.
analis, 233.
burgessi, 230.
furcillata, 232.
marginata, 231.

texana, 231.
tibialis, 232.
Physoconops, 226.
auratus, 230.
brachyrhynchus, 229.
bulbirostris, 228.
excisus, 230.
fronto, 228.
gracilis, 229.
nigrimanus, 228.
obscuripennis, 227.
semifuscus, 228.
sylvosus, 227.
Physonota, 468.
alutacea, 474.
arizonense, 472.
helianthi, 470.
pacifica, 477.
picticollis, 477.
unipunctata, 473.
Planodascalia, 104.
aguayoi, 106.
fusca, 104.
obscura, 105.
viridicosta, 105.
Plusiotis, 210.
woodi, 210.
Polistes, 450.
apachus, 450.
Polytus, 422.
Pselothorax, 541.
atopus, 541.
Pseudoflatoides, 108.
fasciculosus, 108.
fasciatus, 109.
griseus, 109.
maculosus, 110.
vittatus, 109.
lichenoides, 111
tortrix, 110.
flavus, 110.
habanensis, 111.
insularis, 111.
Psychodidae, 8, 247, 455.

Rau, Phil, article by, 326.
Rhabdomastix, 144.
austrocaledoniensis, 144.
Rhabdoscelus, 430.
Rhodobaenus, 427.
Rhinostomus, 417.
Rhyacophila, 17.
belona, 19.
fenderi, 18.
ophrys, 19.
parantra, 17.
Rhyacophilidae, 17.
Rhynchophorinae, 413.
Rhynchophorini, 418.
Rhynchophorus, 419.
Riegel, Garland T., article by, 439.
Ritcher, P. O., article by, 206.
Robertsonomyia, 242.
lovetti, 243.
palpalis, 243.
parva, 243.
Robinson, John H., article by, 27.
Ross, H. H., article by, 17.
Rutelinae, 206.

Sanderson, Milton W., article by, 468.
Satterthwait, A. F., article by, 369.
Scarabaeidae, 206.
Sciastes, 541.
tenna, 541.
Scironis, 542.
autor, 542.
sima, 543.
Scoliidae, 58.
Scylaceus, 544.
amylus, 544.
divisus, 544.
palas, 545.
Scyphophorus, 424.
Shaw, F. R., article by, 189.
Sicus, 245.
Simmons, Perez, article by, 450.
Sipalini, 416.
Siphonaptera, 346.
Sitophilini, 432.
Sitophilus, 432.
Smith, Clyde F., article by, 384.
Sphecidae, 326.
Spirembolus, 546.
cheronus, 546.
maderus, 547.
oreinoides, 546.
orthus, 548.
Stenommatus, 437.
Stenosus, 490.
Strandtmann, R. W., article by, 479.
Stromboscerinae, 413, 434.
Stylogaster, 246.
biannulata, 246.
neglecta, 246.
Sympherobius, 218.
beameri, 220.
Syrphidae, 387.

Tabanidae, 403.
Ta hygyna, 548.
paita, 548.
sima, 549.
watona, 549.
Tapinocyba, 550.
alpha, 550.
gamma, 550.
idahoana, 551.
iowa, 552.
kesimba, 552.
phana, 553.
pontis, 554.
sucra, 554.
vermontis, 555.
Thylodrias, 478.
Tigellinus, 555.
mesus, 556.
perditus, 555.
weber, 557.

Tinea, 28.
pellionella, 28.
Tiphia, 59.
asericae, 59.
bicarinata, 59.
biseculata, 60.
castaneaevora, 60.
frater, 60.
matura, 60.
notopolita, 60.
alleni, 60.
popilliavora, 60, 61.
pullivora, 61.
sternata, 61.
totopunctata, 62.
vernalis, 62.
Tiphiidae, 58.
Tipulidae, 137.
Tomocerinae, 353.
Tomocerus, 356.
missus, 356.
Tomolonus, 353.
reductus, 353.
Tortembolus, 557.
approximatus, 557.
monicus, 558.
Toxorhina, 146.
caledonica, 146.
juvenca, 147.
Trichoptera, 17, 397.
Tritomurus, 356.
Trochorhopalus, 426.
Tyler, John G., article by, 450.

Vespidae, 450.

Warileya, 12.
phlebotomanica, 12.
Weber, Neal A., article by, 267.
Wheeler, Nancy H., article by, 41.
Willibaldia, 559.
sodonta, 559.
Wubana, 560.
reminiscens, 560.

Yeager, J. Franklin, article by, 377.
Yuccaborus, 418.

Zodion, 239.
abitus, 241.
albifacies, 242.
albonotatum, 240.
americanum, 242.
angusticornis, 241.
cinereiventre, 241.
cyanescens, 239.
fulvifrons, 240.
intermedium, 240.
nigrifrons, 242.
obliquefasciatum, 239.
perlongum, 241.
pictulum, 239.
triste, 241.
Zygottus, 560.
corvallis, 561.
oregonus, 561.

MAILING DATES FOR 1948 ISSUE OF THE ANNALS

March Number—June 10, 1948.

June Number—October 19, 1948.

September Number—January 27, 1949.

December Number—March 23, 1949